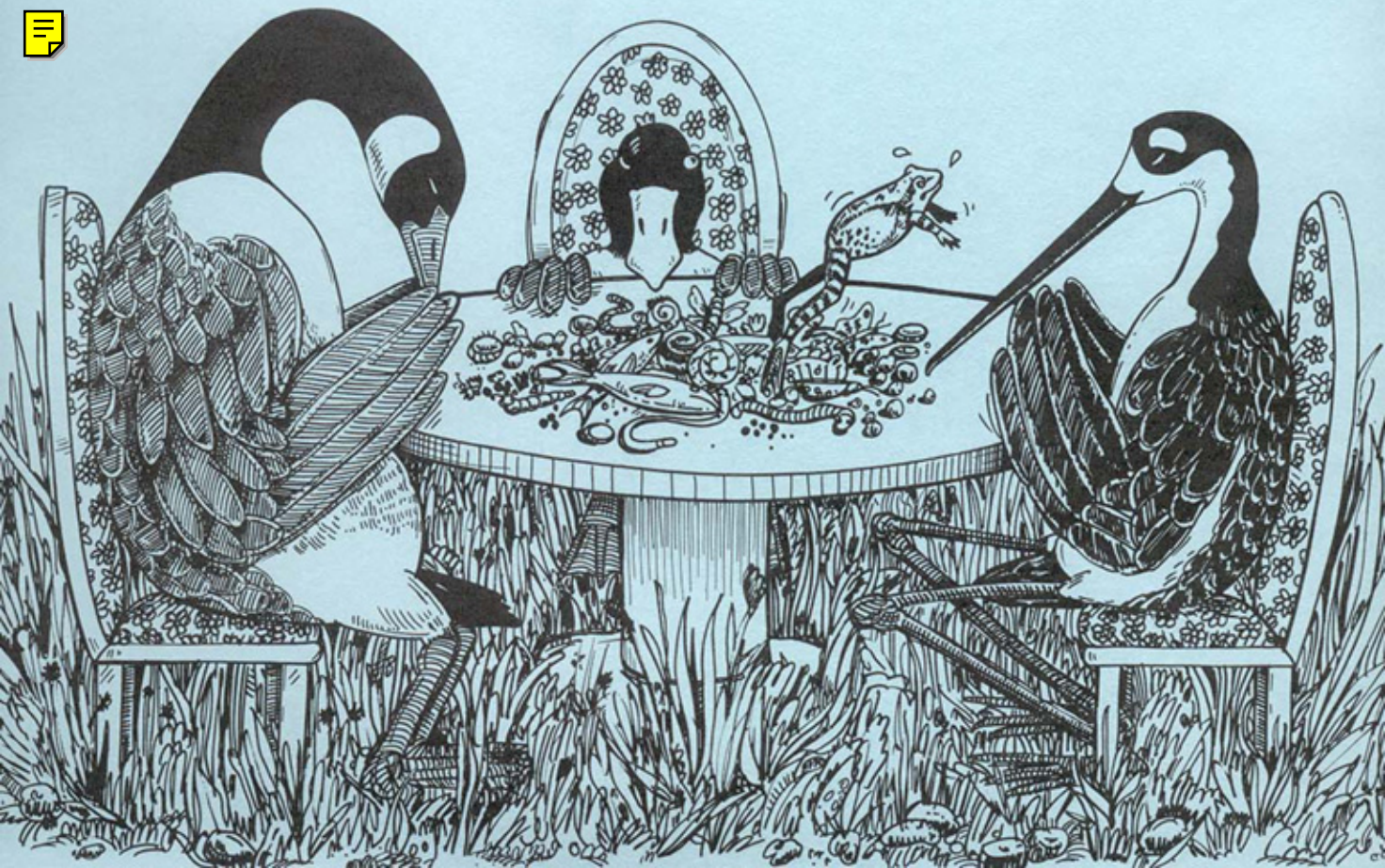


California
Central Valley Habitat
Joint Venture

Habitat Fun Pack

Grades 4-6



Grades 4 - 6

In This Packet:

LANGUAGE ARTS

Habitat Rap Board Game - Rhyming with Raps
Word Find
Water Usage - Collage, Family Discussion
Town Meeting - Oral Presentations
Fill the Bucket - Brainstorming
Wetlands Bingo - Spelling, Speaking, Listening
Vocabulary List
Word Builder
Crossword Puzzle
Word Find - Local Birds
Break a Leg! - Hidden Words
Current Book Selections

MATH

Where Did It All Go? - Percentage
The Probability of Pintails

ART

Duck Stamp Designing
Flight - Chalk Art
Flock of Snow Geese - Mobile
Following Directions - Origami Bird

SCIENCE

Flashcards
Migration Identification
Habitat Mobile - 4 Habitat Needs
Freshwater Marsh Food Web Puzzle
Put Me in My Place - Habitat Match

BACKGROUND INFORMATION

Articles - "Migratory Birds", "Freshwater Marsh",
"Wetlands"

- ★ *Do you need a warm-up activity this morning?*
- ★ *Is PE over, but it's not quite time for recess?*

As part of the Central Valley focus of the North American Waterfowl Management Plan, these games and activities will supplement your environmental education program, while providing "sponge activities" for those short sections of time that occur during the teaching day.

It is hoped that these materials will create an awareness of waterfowl as a disappearing resource, and a sense of value for the birds and their habitat that remains.





**In the Spring You Better Do
A Quick About Face
For Breedin' and Nestin'
The North's the Main Place!**

Drought
Back 2

Take the Rap!

Exhaustion
Back 1

Your babies are
hatched and now
they're ready to fly
south.
Forward 1

Feed in a farm field
Get more energy
Forward 3

The air is getting
cold. Time to go
south!

Take the Rap!

Passing the
Canadian border
Forward 3

Storm hits
Lose a turn

Take the Rap!

Dangerous route -
stormy ahead
Back 1

Washington

Safe resting spot

Take the Rap! can





are Alberta,
nada
ward 2

Disease hits flock
Back 1

Disease controlled
by biologists
Forward 2

Take the Rap!

Habitat is destroyed
Back 1

Habitat found
suitable for feeding
Forward 2

Food is scarce
Back 1

Good weather
Forward 1

Banding of birds
Forward 2

Safe resting spot

Contaminated water
Back 1

Washington

Take the Rap!

Habitat lost
Back 5



Good weather
Forward 1

Oregon

Habitat is lost
Back 4

Safe resting spot

Leaving California
Forward 2

Collision with
powerline
Back 3

Take the Rap!

Safe resting spot

Wildlife refuge -
take a break

Go around storm -
delay
Back 1

Take the Rap!

Safe resting spot

Take the Rap!

Mother Nature calls
Time to fly north!
Forward 1



When Res
Is All You
The South
Better Ge

Sta

Take the Rap!

Blown off course
Lose 2 turns

Oregon

Storm hits!
Lose a turn

Poachers!
Back 3

Take the Rap!

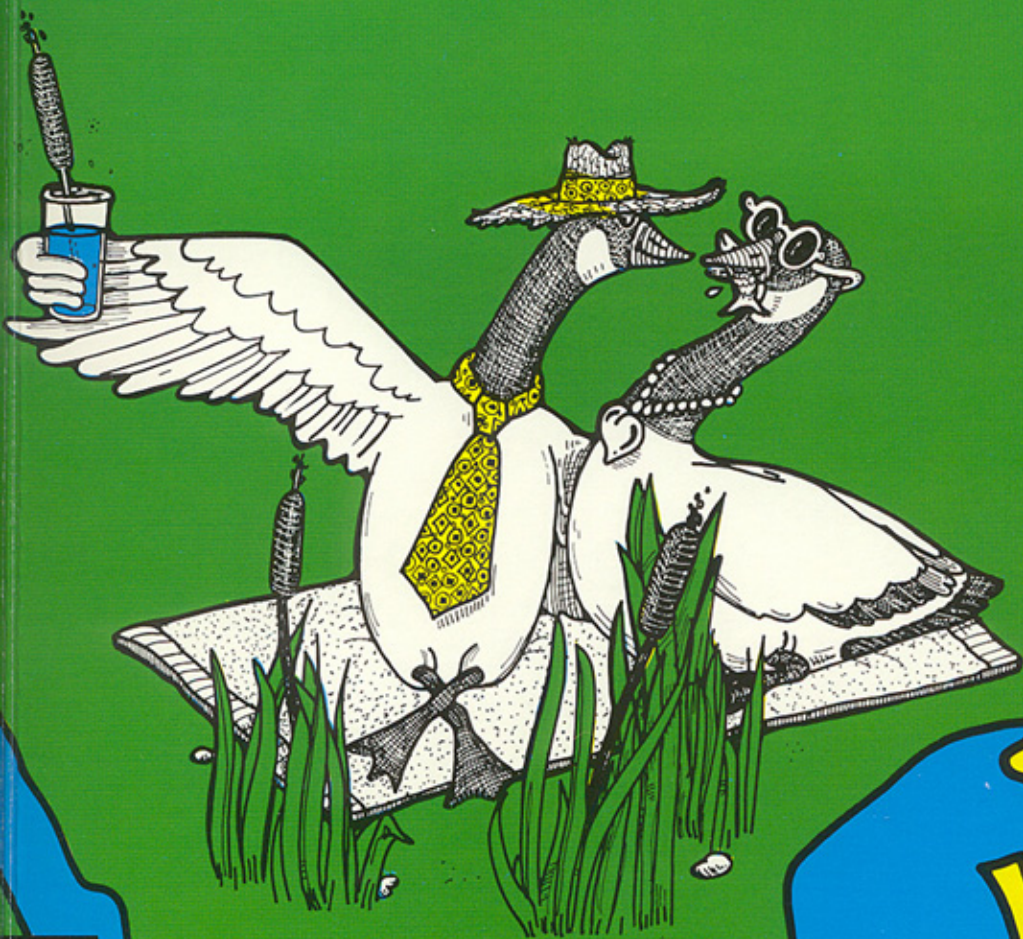
Wildlife refuge
provides food and
cover
Forward 2

Food is scarce
Back 2

Storm ends
Forward 1

You made it
back to
California!

stin' and Feedin'
Wanna Do,
h's Where It's at Man,
et a Clue!



HABITAT RAP

OBJECTIVES:

Students will become acquainted with the concepts of migration, flyway, habitat, and causes of decrease in waterfowl and shorebird populations.

MATERIALS:

Game Board, Spinner Card, Markers, Instruction and Rap Sheets

TIME:

About 20 to 45 minutes

TO PLAY:

Cut rap sheets into cards and place face down on game board. Players start their bird markers in the south and move according to the spinner. The spaces on the board called "Take the Rap" require the oral reading of a Rap Card and movement as indicated on the card. The first player to "migrate" back to California wins.

<p>I fish all day n' sleep all night But somethin' here's a-causin' me a fright. I see more houses n' roads n' malls, Are they gonna leave me any space at all?</p> <p>-2</p>	<p>Great egret is my name snaggin' fish is my game I love them wetlands, yes I do they're good for me and good for you.</p> <p>+2</p>
<p>Did you ever ponder about the times down yonder? And if there's a solution to all of this pollution?</p> <p>-2</p>	<p>I'm Stanley Wigeon and I ain't no pigeon cuz when things get harsh I just head for the marsh.</p> <p>+1</p>
<p>We're at the refuge where the marshes are huge. We're happy ol' Pintails cuz we're dabblin' for snails.</p> <p>+1</p>	<p>Grain in your cereal bowl grain in my tummy I love that grain the farmers grow cuz it's so yummy.</p> <p>+1</p>

<p>I'm a rappin' Mallard Duck but I'm runnin' outta luck. I can't be rappin' like I oughta when they take away the watta'.</p> <p>-4</p>	<p>I'll be home for Christmas if there's a wetland left; if it keeps disappearin' I'll really be bereft.</p> <p>-4</p>	<p>Habitat is where it's at, I gotta find food so I can get fat.</p> <p>+1</p>
<p>The refuge ain't no place to play, the biologists gotta work all day: plantin' food for us birds to get, puttin' in the water so we don't fret.</p> <p>+3</p>	<p>I'm a Northern Shoveler and I think that I'd prefer a nice ol' marshy place without the toxic waste.</p> <p>-3</p>	<p>I'm gettin' kinda sleepy the problem's gettin' huge. The only place that I can rest is on a refuuuuuge.</p> <p>-2</p>
<p>When I wing it to Alaska what I see is shoppin' malls. It don't do me any good to go inside them halls.</p> <p>-2</p>	<p>I'm a Northern Harrier I'm a hawk-like bird. The marsh is where I cruise to lose the hunger blues.</p> <p>+1</p>	<p>Oh, the anticipation of the fall migration. It's a great sensation to fly over the nation.</p> <p>+3</p>
<p>They like to call me Grant I am such a handsome Brant. I fly along the coast cuz the habitat's the most.</p> <p>+3</p>	<p>Sometimes birds can get real sick, a botulism bug can kill us mighty quick. The refuge folks, they study night n' day, they wanna beat the bug... they gotta find a way.</p> <p>-3</p>	<p>New Hampshire and New York ain't really my home, the Pacific flyway is where I like to roam. I rest in the south and breed in the north, when Mama Nature calls, I just gotta go forth.</p> <p>+1</p>

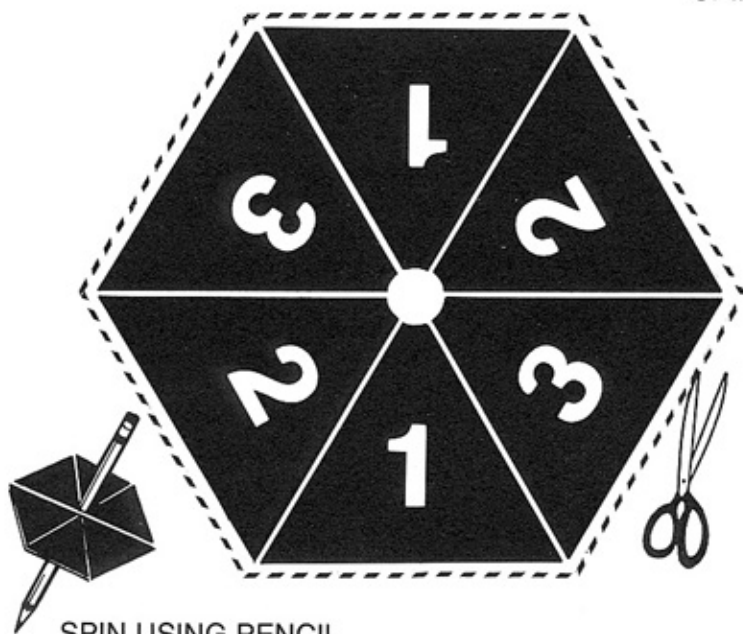
<p>I crave the sanctuaries where I can eat the berries I'll be happy and fat and that's where it's at.</p> <p>+2</p>	<p>I'm a Mallard mama I need some nesting cover to raise my babies I'm a wetland lover.</p> <p>+3</p>	<p>Lots of wetlands have been lost to parking lots and car exhaust. It's just an uptight situation that calls for good ol' conservation.</p> <p>-1</p>
<p>I'm a heron called Great Blue and I'm a-wadin' in the slough tryin' there to sneak some fish into my beak.</p> <p>+2</p>	<p>Don't give me no back-talk jive I need a bunch of stuff just to keep me alive: water and shelter and space and food, I gotta have it all, man, for me and my brood.</p> <p>+3</p>	<p>I'm a shy little Sora I dig thick vegetation If I see you, man, I'm gone with no hesitation.</p> <p>-1</p>
<p>Bugs 'n stuff are my kind of food My name describes my call I'm a neat sort a' dude This Killdeer's on the ball!</p> <p>+1</p>	<p>Pardon my caboose I'm a White-fronted Goose I'm a-comin' here today down the Pacific flyway.</p> <p>+2</p>	<p>When you smell a slough you might think P-U! It ain't a pretty place but it's my very own space.</p> <p>-1</p>
<p>My honking voice is the coolest thing I'm a Canada Goose, and I'm on the wing I graze in the grass, and I swim the lake I'm a big, cool bird, and I ain't no fake.</p> <p>+5</p>	<p>An American Wigeon...I'm a knock-out bird You might think my call is a bit absurd I'm pretty fancy, but my wife is not Our friends all flock together, we like 'em a lot.</p> <p>+3</p>	<p>A wildlife refuge is a heck of a show But too much stompin' through the place makes the birds get up and go. It's hard to figure out what really is the best: let the people see the birds or let the birds take a rest.</p> <p>+1</p>

HABITAT RAP SPINNER

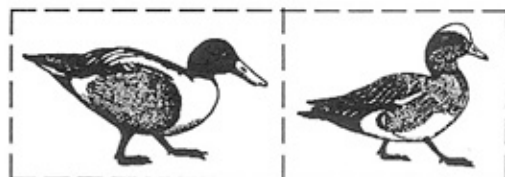
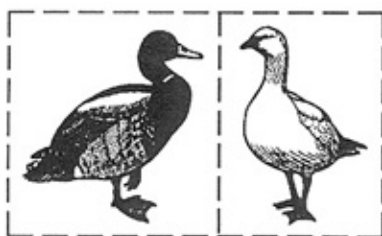
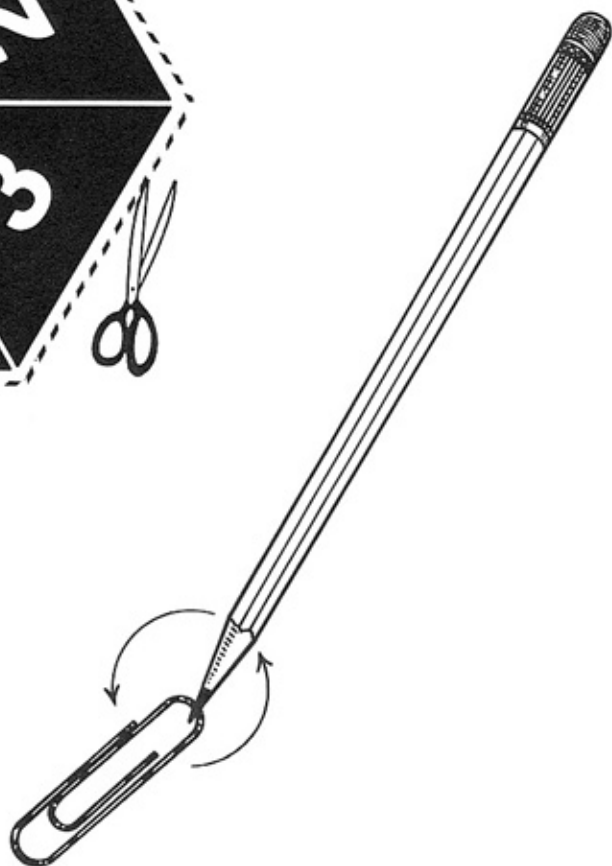
TO USE:

Put a pencil point through the end loop of a paper clip. Hold pencil firmly in the center of the spinner, and flick the paper clip to make it spin.

SPINNER



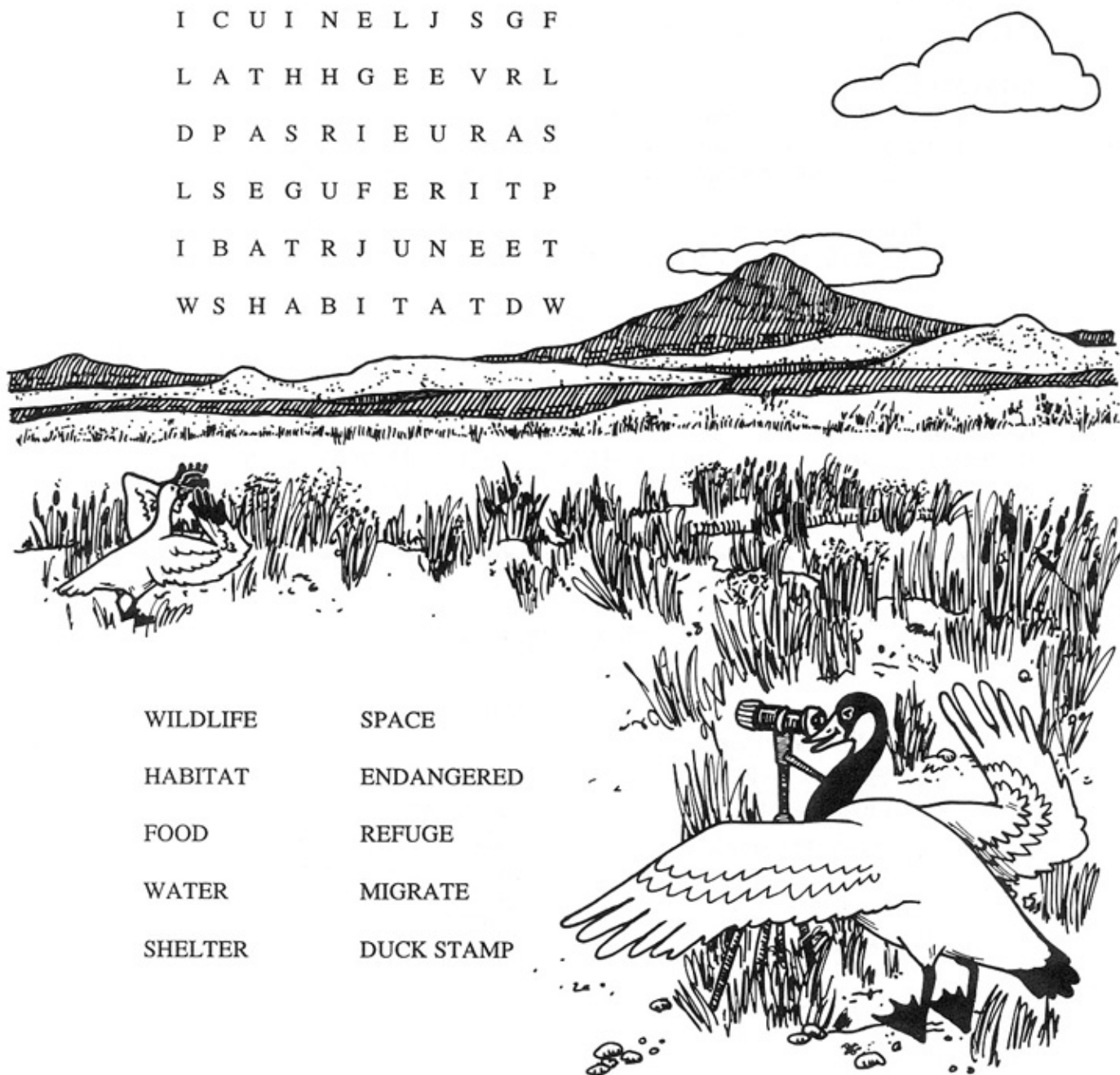
SPIN USING PENCIL



Name _____

FIND THE WORDS

E H V L C W A T E R C
S N Y H D O O F E R I
E N D U C K S T A M P
F E T A M S L K X I O
I C U I N E L J S G F
L A T H H G E E V R L
D P A S R I E U R A S
L S E G U F E R I T P
I B A T R J U N E E T
W S H A B I T A T D W



WILDLIFE

HABITAT

FOOD

WATER

SHELTER

SPACE

ENDANGERED

REFUGE

MIGRATE

DUCK STAMP

WATER USAGE

WATER WORDS

OBJECTIVE:

Students will be able to describe a variety of ways and reasons why water is important to people and wildlife.

HOW TO GET THERE:

Students brainstorm, make collages, and carry out family discussions on water usage and conservation.

MATERIALS:

Large pieces of paper, magazines, scissors, and glue

GO FOR IT!

1. Students discuss all purposes for water.
2. Working in teams, students cut out magazine pictures of water, looking especially for pictures that show how all living things need water.
3. Still in teams, students construct a large collage of overlapping water pictures on one large piece of paper. Display on bulletin board.
4. Final Discussion: Challenge students to think of all the ways they have used water during the day. Stress the importance of water.

ASSIGNMENT:

Duplicate the chart below on tagboard. Send it home to be posted for a few days and discussed by the family. Have students bring back a *list* from home of the ways they could conserve water if there was a shortage.

CAN YOU BELIEVE IT?

Taking a bath	30 gallons
Taking a shower	25-30 gallons
Filling a sink	1-2 gallons
Flushing a toilet	4-6 gallons
Washing clothes	30-50 gallons per load
Washing dishes	6 gallons per load
Washing a car	60 gallons
Watering a lawn	100-200 gallons per hour

WHAT WILL HAPPEN TONIGHT? - A Town Meeting

OBJECTIVES:

Students will gain knowledge of conflicting interests when public policy is being formed. This will be done as the students participate in a public process to decide how land is to be used.

MATERIALS:

Identification cards for each presenter, and a permit for the City Council to hold

TIME:

About 20 to 40 minutes for the presentation

READ TO YOUR CLASS:

Mom and Dad are worried. Whenever there is a town meeting, it causes such a fuss that no one gets anything done for at least three days before and after it happens.

The last open area near the town might be sold - the old marsh. Fifteen acres of it would be sold to Dan the Developer for a shopping center, like the one on the other side of town. It will have department stores.

Everyone around _____ (your town) remembers growing up with the marsh nearby. It was always good for a great adventure or two, even if Mom didn't appreciate the bugs and frogs you brought home in a jar. You were even successful in raising the tadpole eggs to frogs if you remembered to replace the pond water often enough. You fed the ducks that gathered there in the winter months. Even though you fed them slowly, the seed seemed to disappear long before you were ready to go home. The marsh was a great place.

It sure will be hard to see the old marsh go, but Dad said it would be good for business to have some new stores. Plus, you wouldn't have to ride your bike all the way into town. It would be a lot easier.

I wonder what will happen at the town meeting tonight? People want to know if Dan will get a permit to use the land the way he wants to. This might be the last year for tadpoles.

THE PLAYERS:

Barbara the Biologist - from the Department of Fish and Wildlife

Dan the Developer - missed his flight and is late to the meeting

Mr. Bird - represents the Bird Watchers' Society

Mr. History - from the Historical Society

Pam the Planner - from the town planning office

Ms. Politician - running for mayor

Sam the Sportsman - represents those who hunt and fish in the marsh

Brenda the Businesswoman - represents the local business community

City Council - will decide the best use for the land, and give the permit to Dan if the members (3) agree with the plan

Citizens - both happy and upset; all are interested and full of questions

Timekeeper - to keep everyone short-winded - 2 minutes each for the presenters

PRESENTATION:

Each presenter will have 2 minutes to deliver a short speech. Emphasis is on the power of a few well-delivered sentences.

QUESTIONS FROM THE AUDIENCE:

As long as order prevails

DECISION TIME !

After the presentations and any comments from the audience, the City Council adjourns to take a short break and make its decision. The decision is announced.

DE-BRIEFING:

"Now we have to step back from our role-playing. We are the _____ class from _____ (school). I want you to think about certain things:

1. What additional information would have helped you plan your speech?
2. Where would you go to get this information?
3. Who were the leaders during the City Council Meeting?
4. Were you assigned to speak for a group you don't agree with?
(Point out that other people have different needs and ideas, and this might be a way to identify them.)

Simulation games like this one do three things:

1. Clearly explain a problem - The problem we discussed was _____.
2. Show us that things can influence a decision. What things?
3. Show us that there are people interested in the decision. Groups interested in our decision would be: _____."

Barbara the Biologist

Remember Barbara, you stand for the fish and wildlife of the area.
You represent the creatures who cannot speak for themselves.

Could the marsh area be left alone as habitat for the birds?

The ducks use the marsh ponds in the winter and spring when it is
too cold to stay up north in Alaska, Canada, Washington and Oregon.
Curlews, killdeer, stilts and avocets love to hunt for food in the mud,
and the geese love the grassy areas.

Remind people that the marsh is home for many other kinds of fish
and wildlife too.

Long live the wildlife!

Dan the Developer

Remember Dan, you stand for all the investors from San Francisco.

They will put a lot of money into this project. They expect you to convince the people of the town, especially the City Council, that the shopping center will bring jobs for the town and better and easier shopping for the people.

The town has really grown. It needs a shopping center on the north side of the town.

You and your investors will all make a good profit if the shopping center is built.

Go for it!

Mr. Bird

Remember Mr. Bird, your wonderful birds are in danger. As this year's president of the Bird Watchers' Society, it is up to you to save them! If Dan the Developer puts in that shopping center, not one bird will return to the area. All that habitat will be lost forever. Not only are there very few areas left for the birds, there are very few places left for people to watch birds and enjoy nature and the outdoors. Hang in there for your birdwatcher friends and your feathered friends!

Mr. History

Remember Mr. History, that you stand for all the old places that are left in this town, and, there aren't many left.

The first family to settle in the area built their barn on the edge of that marsh, and it is still standing today.

That barn is over 100 years old and should be preserved in some way, not torn down.

And of all the bad luck, it is on the piece of land that may be sold to Dan the Developer. There is no way he is going to let the barn stand. You've got to convince the City Council members to grant the permit ONLY if the barn can be saved.

Mr. History, fight for the past!

Pam the Planner

Remember Pam, you are to look at all of the town's needs, because your job is to help find the best solution for all of the town's citizens.

The town really needs the new jobs the shopping center will bring.

However, you also have to think about all of the new roads a shopping center will require. How will the town pay for them?

The town needs to clean up the river which flows by the marsh and on into town. The marsh could be a natural water filter to remove silt and absorb pollutants. Does the marsh provide other benefits people are forgetting?

Is there a way to build the shopping center so that all of the marsh won't be lost?

Pam, the City Council members want to know what you think, so think hard.

Ms. Politician

Remember Ms. Politician, that you want to represent the town as mayor next year, so you had better start lining up the votes now!

How can you stand for both the shopping center, which will put more people to work, and the people like Mr. Bird, who has all of his bird-watcher friends ready to vote for your opponent.

So, just think of a plan that will make Dan and the nature lovers happy.

Now is the time to show this town what a leader you can be!

Sam the Sportsman

Remember Sam, you represent all of the people of the town who like to fish and hunt in the marsh.

Men and women interested in outdoor sports such as hunting and fishing want to protect natural areas where fish and wildlife live.

There are fewer and fewer places to go and enjoy these activities with your children or friends.

You want to save those places that are left.

You represent local businessmen and women and you want the town to grow and prosper.
The shopping center would bring jobs and money into the town, and you think that would be good for everyone.
You support Dan the Developer and want the shopping center built.

Brenda the Businesswoman

City Council Member

Remember City Council member, that you were elected by the people of the town to represent them - all of them.

You must listen carefully to all the speakers and people from the audience before you decide whether to grant the permit to Dan.

You might grant the permit only if some changes are made in the plans. What would those changes be? If you give him the permit so the sale can go through, you had better be ready with good reasons why.

The town is waiting for your answer.

Timekeeper

Remember Timekeeper, the folks at the town meeting are going to be excited.

It is your job to see that each of the eight speakers does not go over the time limit of *2 minutes* each.

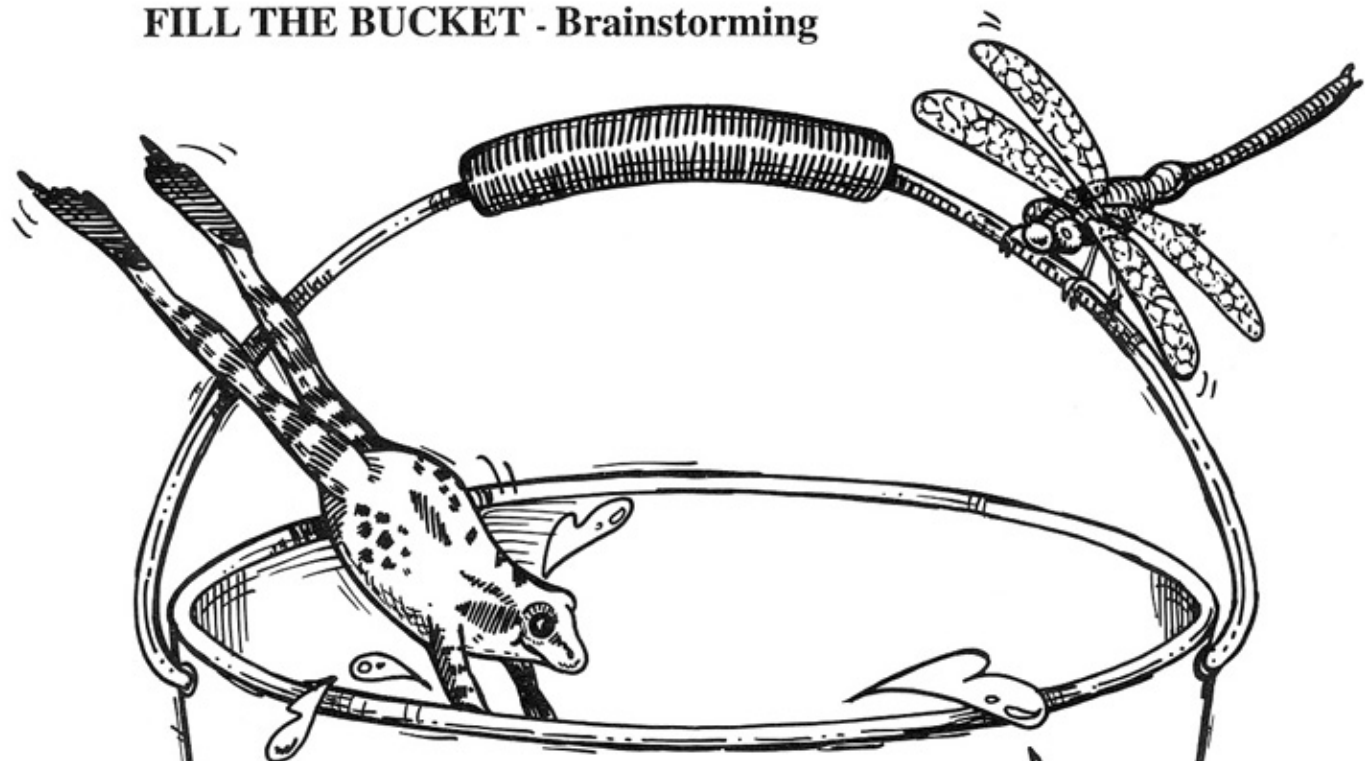
Questions from the audience should be short - about 20 seconds each.

The City Council members are counting on you to help keep order tonight.

Good luck!!

Permit

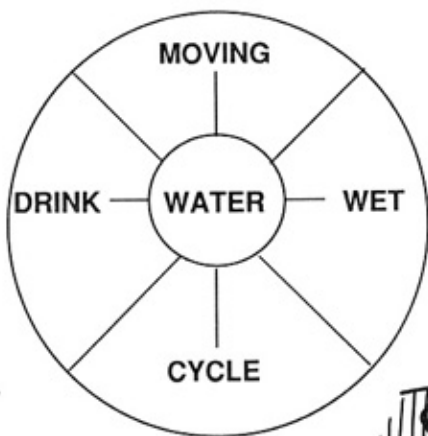
FILL THE BUCKET - Brainstorming



Draw a huge bucket on the board. Challenge the class to fill the bucket with words that have something to do with water, including its importance to people and wildlife.

As you go, keep students stretching into new areas by suggesting examples and categories of ideas if they get bogged down.

Using the list of words, ask the students to create water wheels. Begin with a simple water wheel like this:



WETLANDS BINGO

You start it - the class continues

OBJECTIVE:

Students will see, hear, write, say, and spell wetlands vocabulary.

MATERIALS:

Pencils and paper

GO FOR IT!

1. Put these wetlands words on the board or the overhead projector:

marsh	wildlife	habitat	food
water	shelter	space	soil
fish	swim	dive	fly

Also use the words from the VOCABULARY LIST on page two of this activity, and add other words as the class thinks of more.

2. Students write any five words on their papers. Give about two minutes for quiet study.
3. Slowly, call out the words (but not in order), and mark them off as you go. When a word on a student's paper is called, the student marks off the word.
4. After a student has marked off all five words, he/she jumps up and shouts "BINGO!" The words on the paper must be checked and spelled correctly out loud. Then the student is up and the game begins again.

As the teacher, you are the first one up. Then sit back and relax!

VOCABULARY LIST

4-6

HABITAT - A balance of food, water, cover, and space which satisfies animals' needs for life

WETLAND - A place where the soil is always moist or covered with water

MARSH - A type of wetland where water lilies and cattails grow

ESTUARY - A place where fresh water and salt water come together

UPLANDS - Slightly elevated dry lands

WILDLIFE - Large or small animals that are not domesticated

WILDLIFE REFUGE - An area set aside by the government to be managed on behalf of the wildlife living there. Management includes planning, repairing, and improving the animal habitats, and teaching people about wildlife.

MIGRATION - Movement of birds between their breeding and wintering grounds

FLYWAY - A path birds travel when migrating between their breeding and wintering grounds

ORGANISM - A living creature

SPECIES - A group of animals that are mostly alike and can produce offspring

ENDANGERED - A certain species in danger of disappearing from the earth

DEVELOPMENT - Land that has been changed by man through farming, dredging, or the construction of roads and buildings. Land that is being used in a new way

RESOURCE - Part of our natural surroundings that we value and use

CONSERVATION - A careful protection of our natural resources so that they can be available in the future

POLLUTION - Occurs when people put unhealthy materials into the environment

ECOLOGY - The study of how organisms live and act in their environment

WORD BUILDER

Name _____

How many words can you make from.....

HABITAT IS FOR THE BIRDS!

1.

6.

2.

7.

3.

8.

4.

9.

5.

10.

Think of more!

11.

16.

12.

17.

13.

18.

14.

19.

15.

20.



CROSSWORD PUZZLE

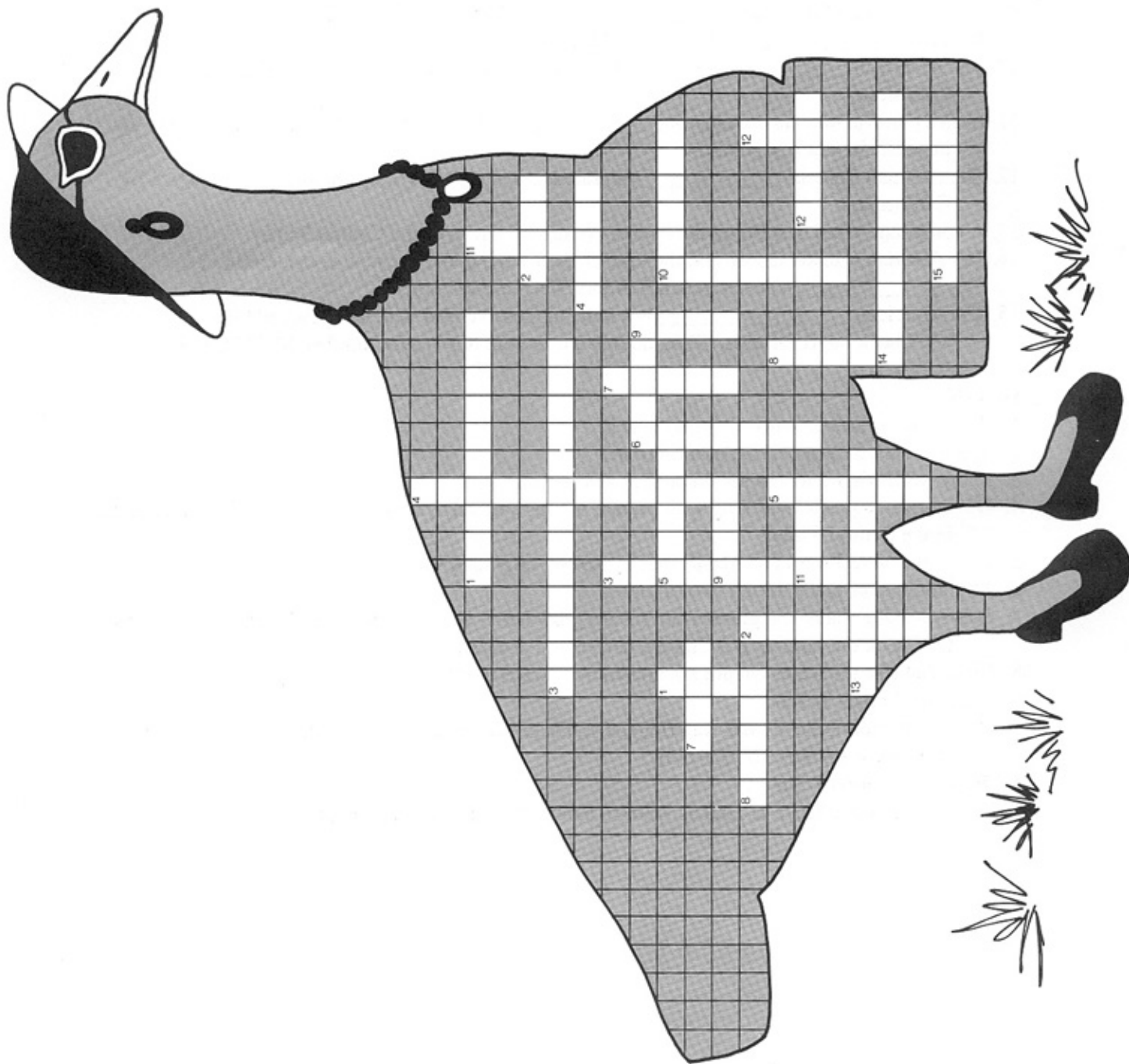
...See clues **

ACROSS

1. This state provides one of the great wintering areas for birds along the Pacific Flyway.
2. To give assistance
3. This area has suffered a 95% loss of wetlands over the last 100 years. This is more than any other major ecological unit has lost in the entire North American continent.
4. The object of our efforts
5. An area set aside for the preservation of wildlife and its habitat
6. A wetland that is dominated by **shrubs or trees-(Head for the dictionary. This is tough.)
7. _____, water, cover, and space are needed for waterfowl habitat.
8. Waterfowl need food, water, _____, and space for their habitat.
9. We have to _____ about our wildlife resources.
10. The American _____ is seen in great numbers as it winters all through California.
11. Restrictions on hunters are only one _____ that is used in the efforts to preserve and increase the duck population.
12. The Aleutian Canada _____ migrated eastward 1,000 miles before setting course for California.
13. A compound word describing the swans, geese, and ducks of the Central Valley
14. The Aleutian Canada Goose and the tule white-fronted goose are now considered to be _____ species because of their decrease in numbers.
15. The American _____ is a loud, aggressive bird with an upcurved bill.
(**Check the flashcards. Then double check your answer for number 10 ACROSS.)

DOWN

1. What action can you perform with water?
2. The place where a species is usually found
3. Many wetlands are lost to this kind of development.
4. Government agencies working with private groups and citizens to save the remaining bird habitat in the Central Valley
5. A route from California to Alaska that is used by migrating birds
6. Migration takes place during two of these.
7. Soft-stemmed plants and grasses and rushes grow here - also cattails, water lilies, and duckweed.
(**Check out number 6 ACROSS before you decide.)
8. Birds that like the water but are not considered "waterfowl" live on the _____.
9. An animal taken as food
10. An area that periodically has waterlogged solids or is covered with a shallow layer of water.
(**Look at number 10 ACROSS.)
11. Possessive form of "they".
12. The right to use a piece of land as wildlife habitat without owning the land



WORD BANK

POUR
 WATERFOWL
 JOINT VENTURE
 BIRDS
 MARSH
 REFUGE
 CENTRAL VALLEY
 THEIR
 CARE
 SHORE
 WIGEON
 EASEMENT
 AVOCET
 FOOD
 AGRICULTURE
 HELP
 TOOL
 WETLAND
 ENDANGERED
 COVER
 CALIFORNIA
 FLYWAY
 SWAMP
 PREY
 GOOSE
 HABITAT
 SEASONS

NAME _____

WOOD DUCK
STILT
SNOW GOOSE
COMMON FLICKER
SANDHILL CRANE
WARBLER
NORTHERN PINTAIL
GREAT BLUE HERON
HARRIER HAWK
KINGFISHER
AMERICAN BITTERN
AMERICAN WIGEON
WESTERN MEADOWLARK

CURLEW
MALLARD
AVOCET
GREAT EGRET
RING-NECKED PHEASANT
PIED-BILLED GREBE
KILLDEER
CANADA GOOSE
WHITE-FRONTED GOOSE
CALIFORNIA QUAIL
RUDDY DUCK
RED-WINGED BLACKBIRD
NORTHERN SHOVELER

CENTRAL VALLEY BIRDS

V	T	A	A	C	T	L	M	R	E	L	E	V	O	H	S	N	R	E	H	T	R	O	N
R	W	O	B	A	A	M	N	O	R	E	H	E	U	L	B	T	A	E	R	G	U	V	S
X	U	O	P	O	S	L	O	P	E	B	E	R	G	D	E	L	L	I	B	D	E	I	P
K	Y	Z	A	A	R	R	I	N	G	N	E	C	K	E	D	P	H	E	A	S	A	N	T
Q	I	O	J	C	K	L	J	F	A	M	E	R	I	C	A	N	W	I	G	E	O	N	S
R	V	N	Q	C	D	N	C	B	O	F	L	S	C	C	U	D	D	L	O	W	L	M	A
D	U	P	G	A	E	K	D	L	N	R	M	E	K	D	J	W	I	H	F	G	K	N	N
P	W	D	H	F	O	R	E	D	W	I	N	G	E	D	B	L	A	C	K	B	I	R	D
E	F	G	D	A	I	E	A	B	B	Z	A	I	C	T	S	B	A	R	R	A	L	O	H
O	X	O	O	Y	I	S	F	H	L	G	Y	B	A	B	U	Y	A	L	B	Q	M	P	I
K	B	A	M	H	D	G	H	L	C	B	A	L	L	Q	V	L	E	B	O	L	B	N	L
N	Y	M	F	G	O	U	H	E	U	A	A	X	A	W	U	G	H	O	D	L	E	O	L
M	B	O	B	O	B	I	C	K	R	O	N	O	O	X	F	A	E	O	C	P	O	R	C
P	E	N	J	A	O	L	J	K	L	A	Q	A	A	F	O	X	I	A	B	A	Q	P	R
M	Z	B	A	N	O	R	T	H	E	R	N	P	I	N	T	A	I	L	Z	M	O	R	A
E	B	K	C	U	D	D	O	O	W	A	P	O	L	I	A	C	D	M	O	A	O	S	N
S	R	E	K	C	I	L	F	N	O	M	M	O	C	W	P	S	T	I	L	T	O	O	E
O	W	H	I	T	E	F	R	O	N	T	E	D	G	O	O	S	E	R	S	S	U	U	O
O	H	A	R	R	I	E	R	H	A	W	K	N	G	O	A	I	F	E	T	X	V	A	V
G	H	G	A	V	O	C	E	T	F	M	K	L	M	S	N	J	M	A	L	L	A	R	D
W	H	K	R	A	L	W	O	D	A	E	M	N	R	E	T	S	E	W	O	V	O	W	B
O	A	M	E	R	I	C	A	N	B	I	T	T	E	R	N	Y	V	X	A	W	A	B	X
N	C	O	B	E	A	D	O	Z	C	G	R	E	A	T	E	G	R	E	T	W	A	Y	A
S	K	I	L	L	D	E	E	R	D	A	E	B	E	S	O	O	G	A	D	A	N	A	C

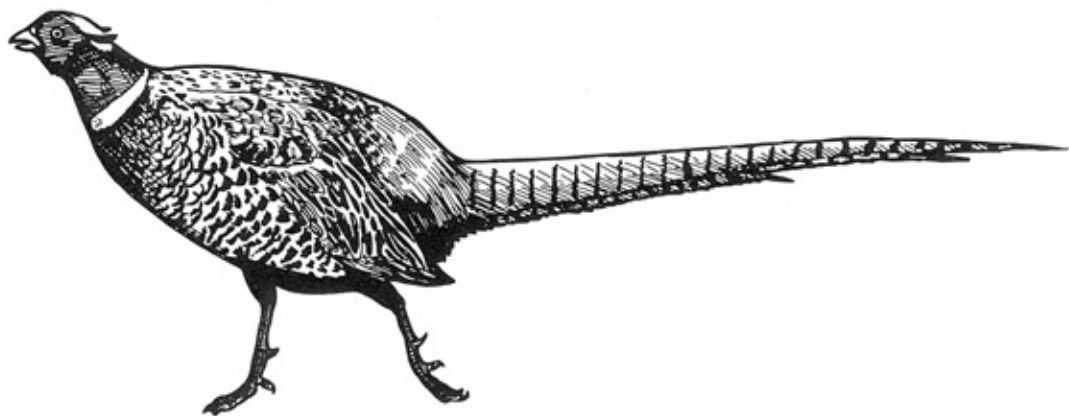
NAME

BREAK A LEG!

Can you find the hidden Central Valley birds? Good Luck!*

*GEESE is hidden in #1

1. GEE, SEAN, YOU'RE JUST NOT RIGHT FOR THE ROLE.
2. NOW, DON'T GIVE ME ANY LIP. HE, AS ANTELOPE AL, WILL BE PERFECT FOR THE PART.
3. AH, AWKWARD LINES ARE HARD TO MEMORIZE.
4. ACCORDING TO THE SCRIPT, THE CROWD, IN PANIC, RAN EVERYWHERE.
5. THE SPOTLIGHT PICKED UP THE INJURED FATHER ON THE STAIRS.
6. "OGRE, BEGONE!" THE ACTRESS CRIED OUT.
7. DON'T START THE FINAL REHEARSALS 'TIL THE DIRECTOR GETS HERE.
8. THE STAR SENT REGRETS THAT HE COULDN'T ATTEND THE OPENING.
9. THE LIGHTS FLICKERED, THE CROWD BECAME QUIET, AND THE PLAY BEGAN.
10. NOW, THE PLAYERS WANT A BIG PARTY TO CELEBRATE THE GREAT REVIEWS!



(Cut this part off if you want to give them a real challenge.)

WORD BANK:

CROW
HAWK
GREBE
FLICKER

GEESE
CRANE
STILT
SWAN

PHEASANT
HERON
EGRET

CURRENT BOOK SELECTIONS

4-6

FOR INFORMATION:

Birds of Prey, Nature Watch Series, 1988
Bird's Nest, Barrie Watts, 1987
Swans, Jack D. Scott, 1987
The Call of The Trumpeter Swan, Jay Featherly, 1986
Adaptable Birds, John Andrews, 1985
Birds, David Cook, 1985

FOR FUN:

Simon the Swan, Cicely M. Berker, 1989
Sea Swan, Kathryn Lasky, 1988
Oliver and the Lucky Duck, Page McBrier, 1986
The Pheasant, Kimio Endo, 1986

Also see older books:

Commander the Gander, David McKelvey, 1984
The House of Wings, Betsy C. Byars, 1982
Compass Merit Badge Book, Boy Scouts of America, 1981
A Field Guide to the Birds, Roger Tory Peterson, 1980
Birds and How They Function, Phillip S. Callahan, 1979
Habitat Guide to Birding, Thomas P. McElroy, 1974
The California Wildlife, Vinson Brown & George Lawrence, 1965

WHERE DID IT ALL GO? ... A Chalk Talk

California's Central Valley once had four million acres of wetlands. This area has declined drastically. In the past 100 years 95% of California's Central Valley wetlands have been lost. The main cause of the decline has been the change from wetlands to agriculture. There are 100,000 acres of state and federal refuges and wildlife management areas and about 180,000 acres of private lands left in remaining wetlands.

One Mile = 5,280 feet

One Square Mile = (?) 27,878,400 ft.

One Acre = 43,560 square feet

There are 640 acres in one square mile (27,878,400 / 43,560)

QUESTION: How many acres are left in the Central Valley?
280,000 - See above

How many square miles of wetlands are left?
About 438 square miles - 280,000 / 640

This figure represents the 5% that is left.

QUESTION: How many acres were there 100 years ago?

$$5\% = 280,000$$

$$280,000 / .05 = 5,600,000 \text{ acres}$$

QUESTION: How many square miles of wetlands were there 100 years ago?

$$5,600,000 / 640 = 8,750 \text{ square miles.}$$

QUESTION: What state is close to that size?
(Head for the encyclopedias or an atlas.)

The PROBABILITY of Pintails

Many things are possible, but the chances of some things happening are even better than that. They are **probable**. We learn about **probability** in math, and it is shown as a fraction.

2 blue marbles	When you reach in the marble bag
1 white marble	the probability of getting a blue marble is $\frac{2}{3}$. A white marble?

When we look at percentage (comparing by the 100, or **per** 100), we can also see probability. Look at the different kinds of ducks seen on one wildlife refuge:

Pintails	36%
American Wigeon	20%
Green-winged Teal	16%
Mallard	11%
Northern Shoveler	10%
Unidentified	7%

The probability of a duck at this refuge being a pintail is 36 out of 100, or $P = \frac{36}{100}$.

DUCK SPOTTINGS

Now, use a calculator to look for ducks.

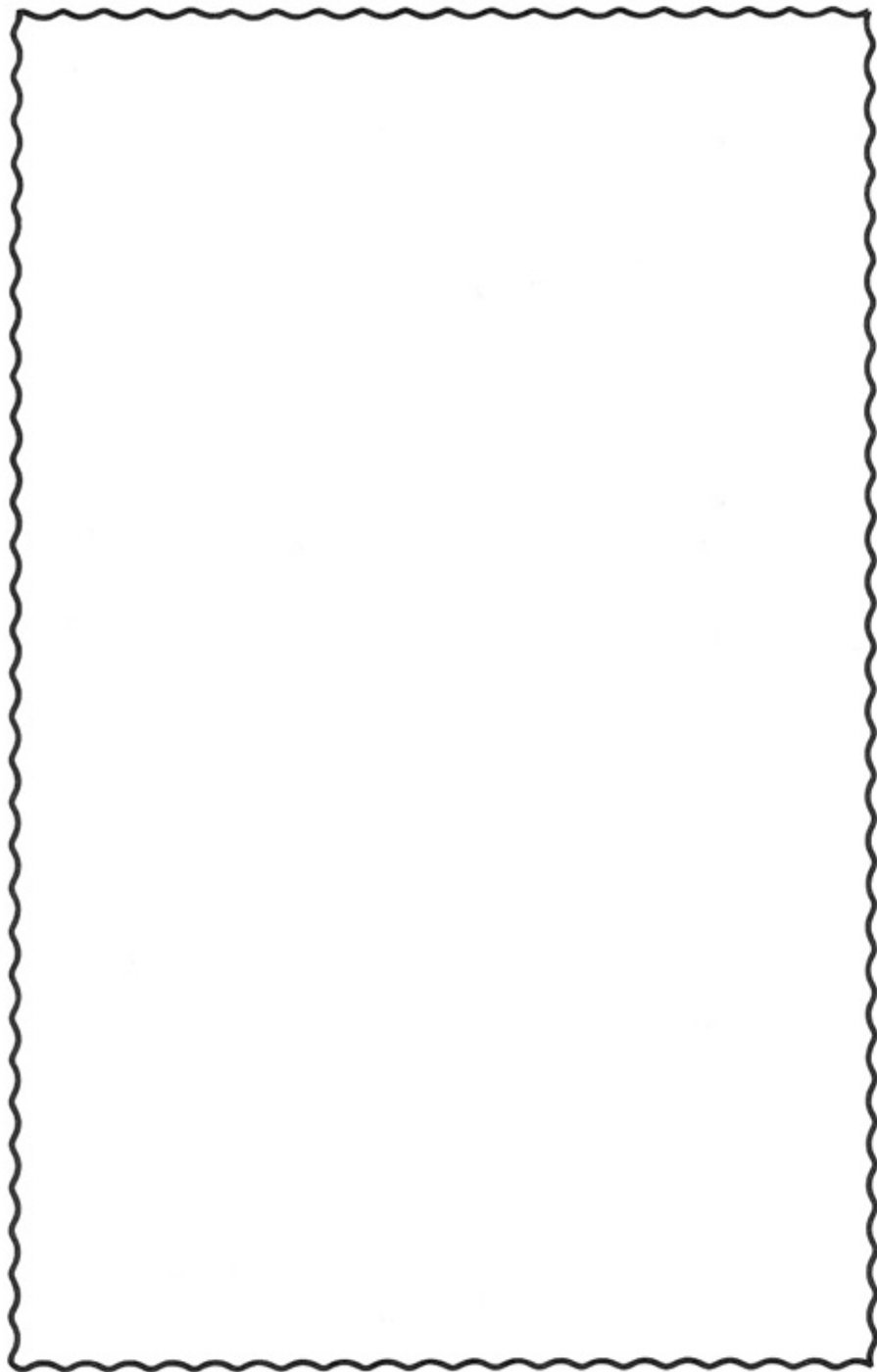
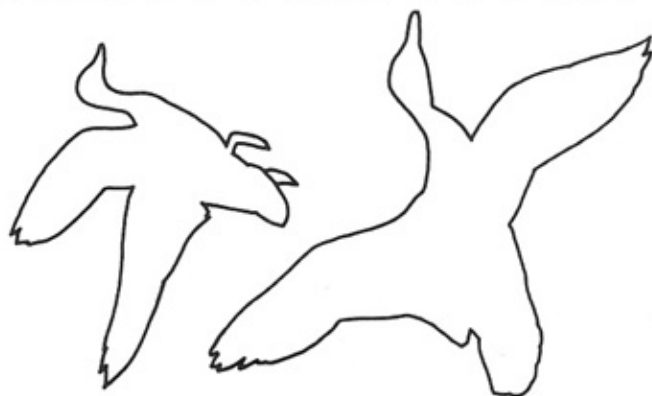
If there were 12,000,000 duck spottings (sightings), how many of them would be:

Pintails?	$\frac{36}{100} \times 12,000,000 = \underline{4,320,000}$
American Wigeon?	2,400,000
Green-winged Teal?	1,920,000
Mallard?	1,320,000
Northern Shoveler?	1,200,000

Name _____

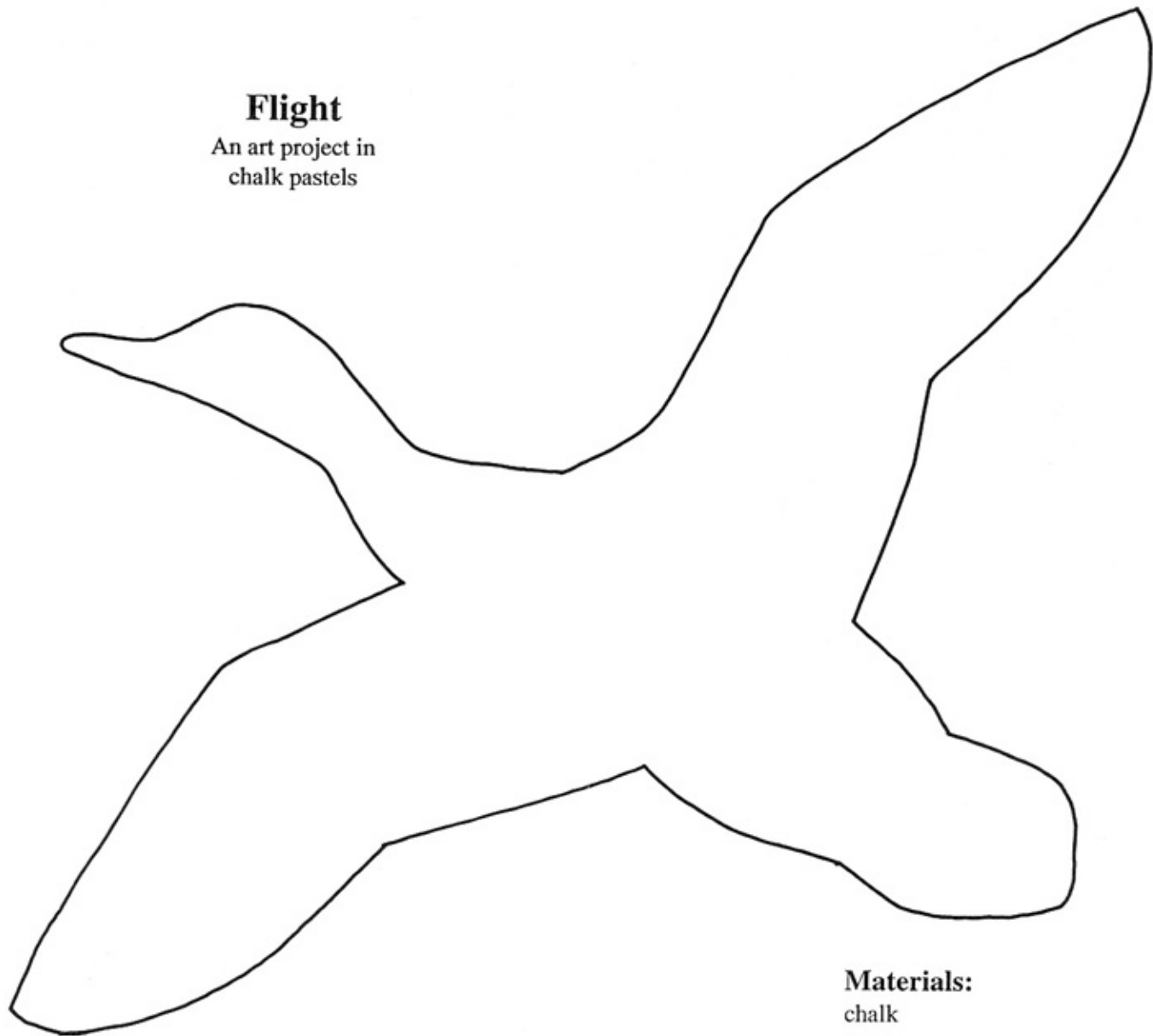
DUCK STAMP DESIGNING

Hunters buy a ticket to hunt. Other people who are also interested in birds buy it too. The ticket is called a Duck Stamp, and the money from selling the stamp buys land for the birds. Draw your own Duck Stamp here:



Flight

An art project in
chalk pastels

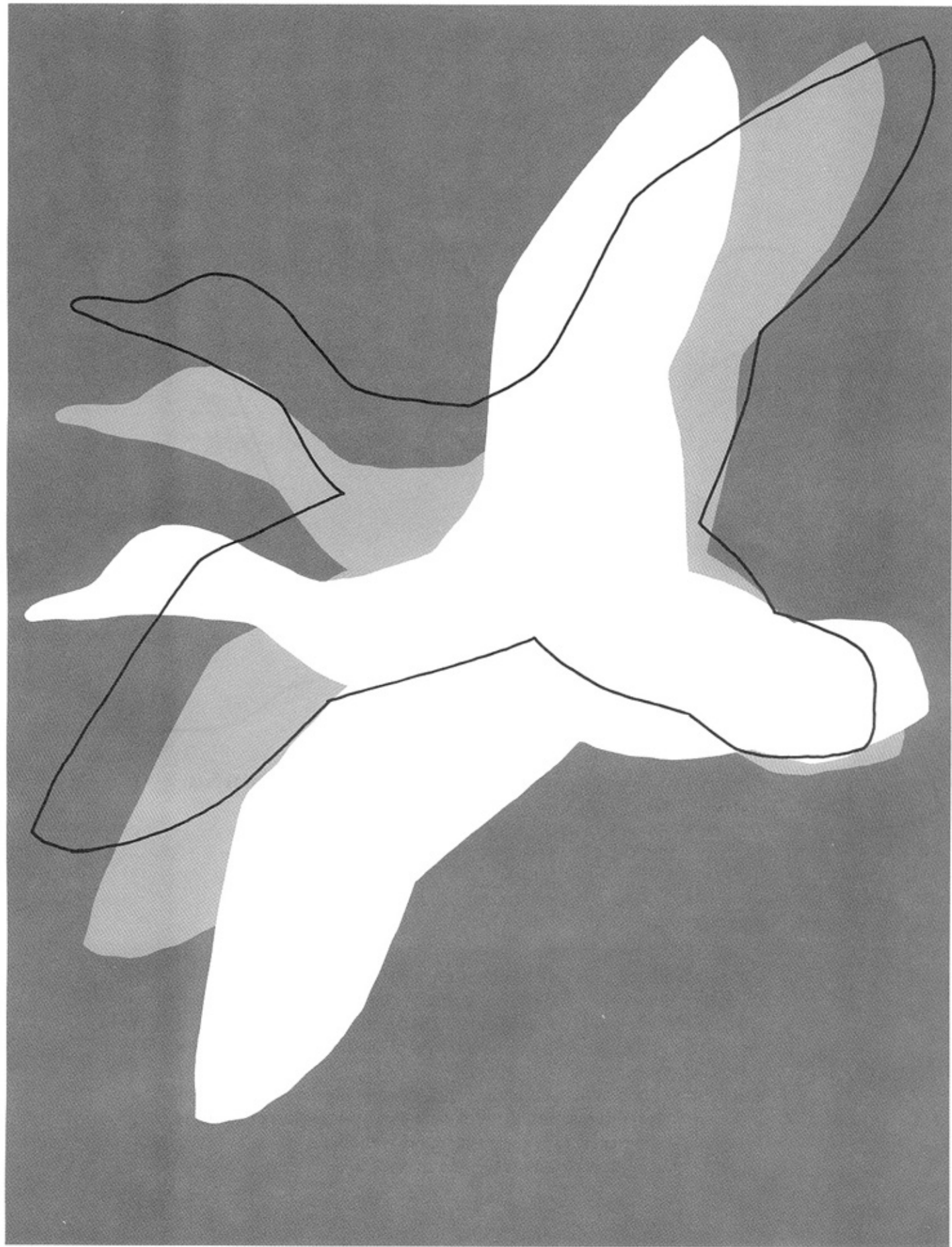


Materials:

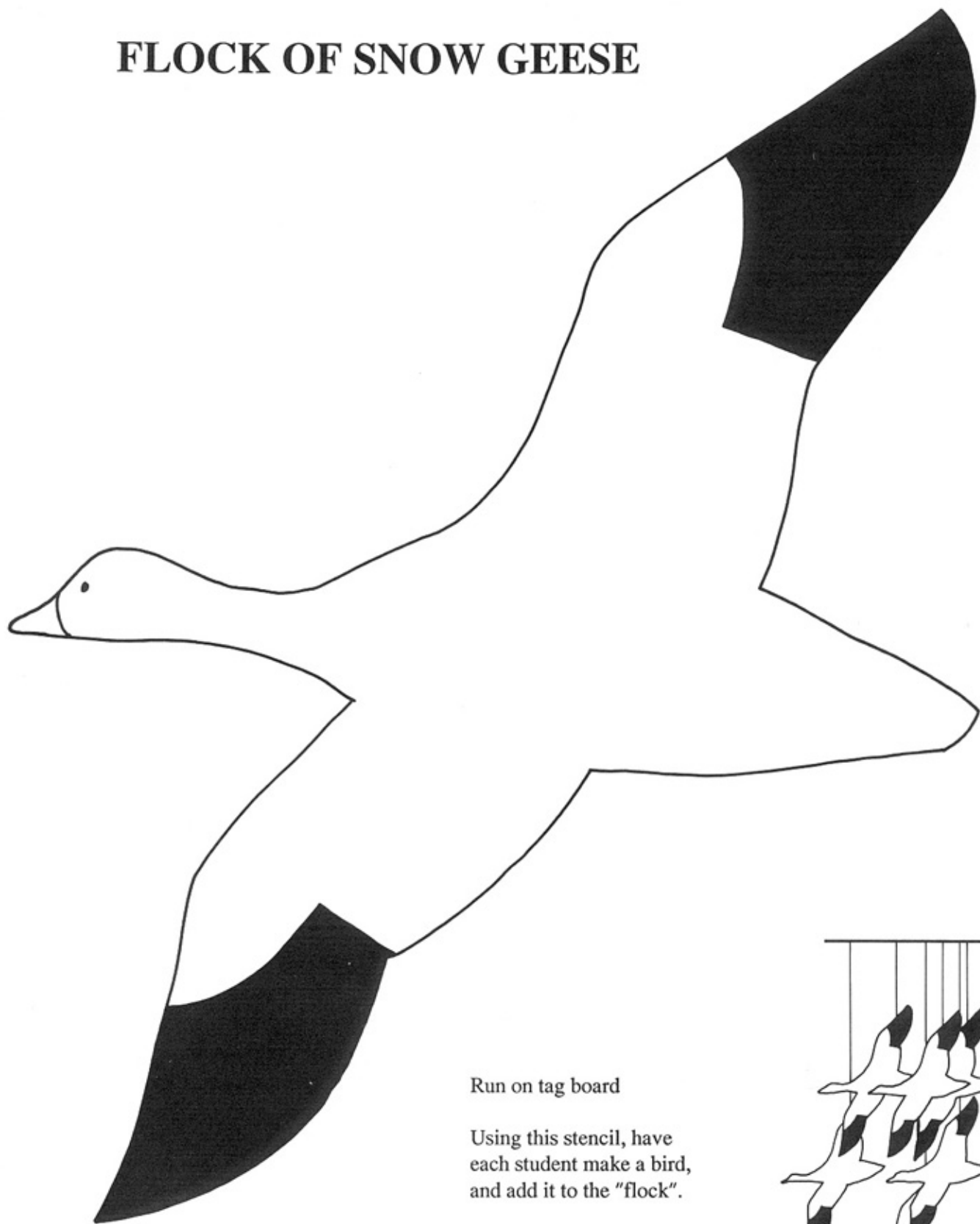
chalk
paper
scissors
Kleenex

Run on tagboard

1. Cut out the stencil and chalk it heavily on one side.
2. Place it on clean paper, and holding it firmly with one hand, use the other hand to wipe the chalk from the center of the bird to the edges of the paper.
3. Prepare the bird again, with a different color of chalk. Watch out for smudges on your hands or the paper.
4. Place the bird on another part of the paper, overlapping the first outline that you made, and brush this color off the bird, onto the paper and out to the edges.
5. Repeat until desired effect is achieved. Spray with fixative.
6. Finally, you may want to outline the bird in black ink.



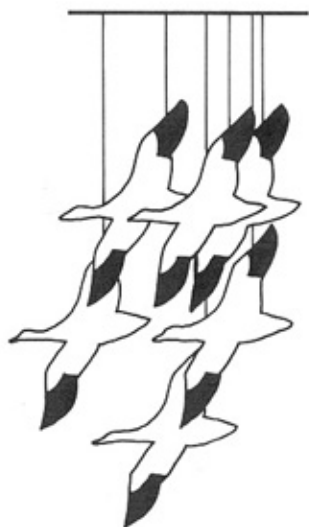
FLOCK OF SNOW GEESE



Run on tag board

Using this stencil, have each student make a bird, and add it to the "flock".

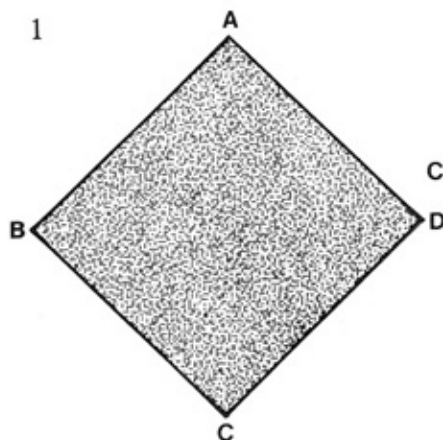
One wire hanger will take at least a flock of six.



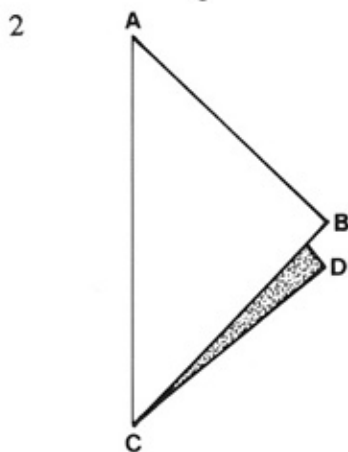
FOLLOWING DIRECTIONS ...An Origami Bird...Step by Step

Demonstrate this with 5 students, and let them teach others in small groups.
Label points and corners as you go.

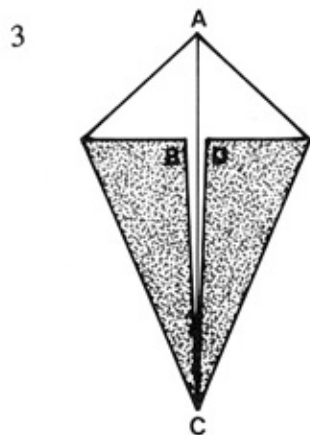
1. Place a square sheet of paper (included) on the table with one of the corners toward you. Label the top point A, the left point B, the bottom point C, and the right point D. See Figure 1.



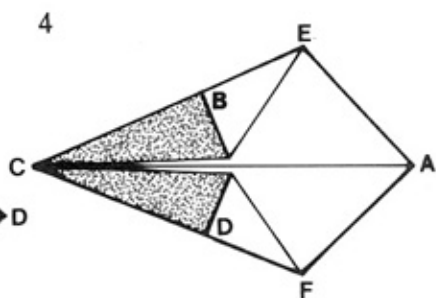
2. Fold point B to point D, forming line AC. See Figure 2.



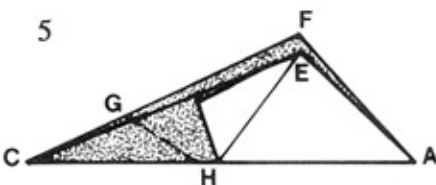
3. Open paper and fold line BC to AC. Repeat with line DC to AC. See Figure 3.



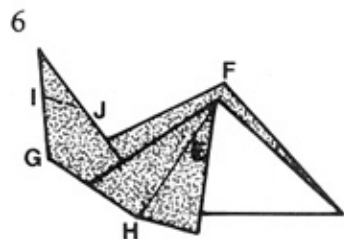
4. Put the paper down so C is on the left. Label the top corner E and the bottom corner F. Fold BE to meet CE. Repeat with DF to meet CF. See Figure 4.



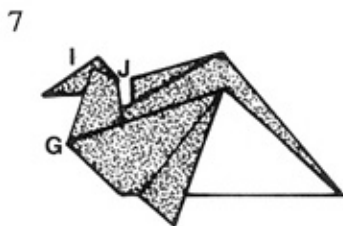
5. Fold so that E falls on F and crease the fold. Draw a line GH that is parallel to F as in Figure 5. Fold up on line GH. This forms the neck.



6. Unfold the neck. Open the shape at points E and F. Push the neck in between E and F and crease again on GH. Label a diagonal line IJ on the neck (forms head). See Figure 6.



7. Fold the head down on IJ. Unfold the head and open the neck fold. Push the head down inside the neck fold so that the head is in the center of the neck. Crease at the top of the head as in Figure 7.



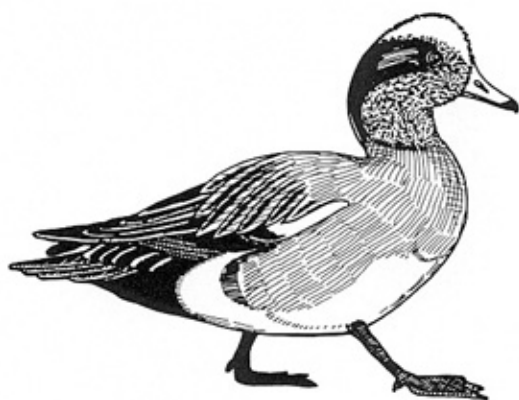


American Avocet
Black-necked Stilt

American Bittern

American Wigeon

Belted Kingfisher

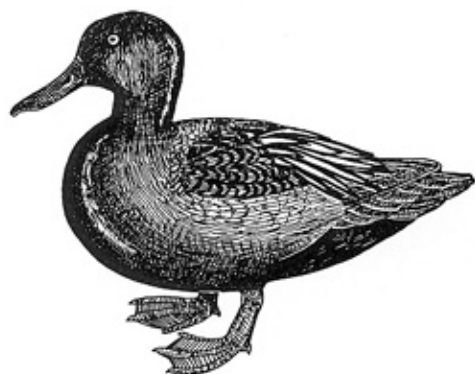
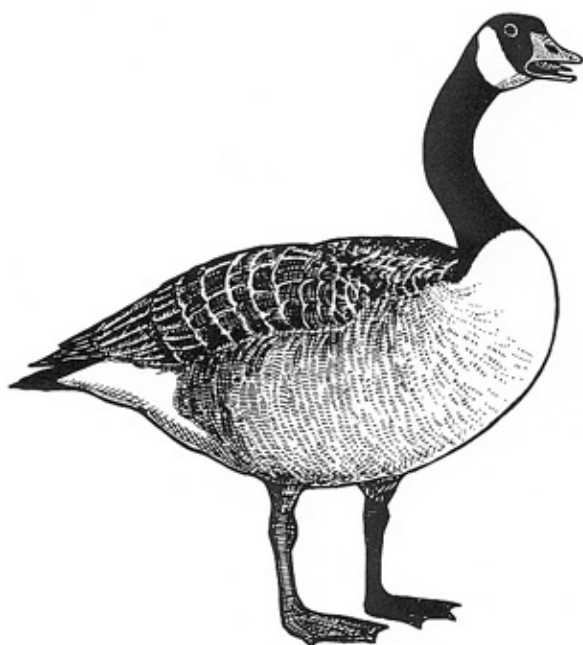


Canada Goose

California Quail

Cinnamon Teal

Canvasback

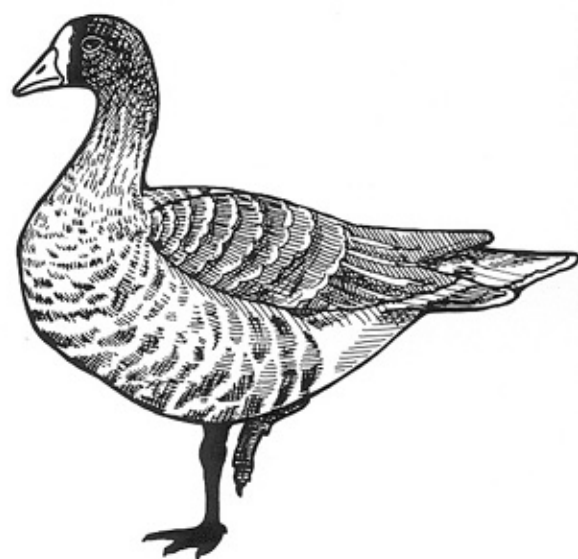
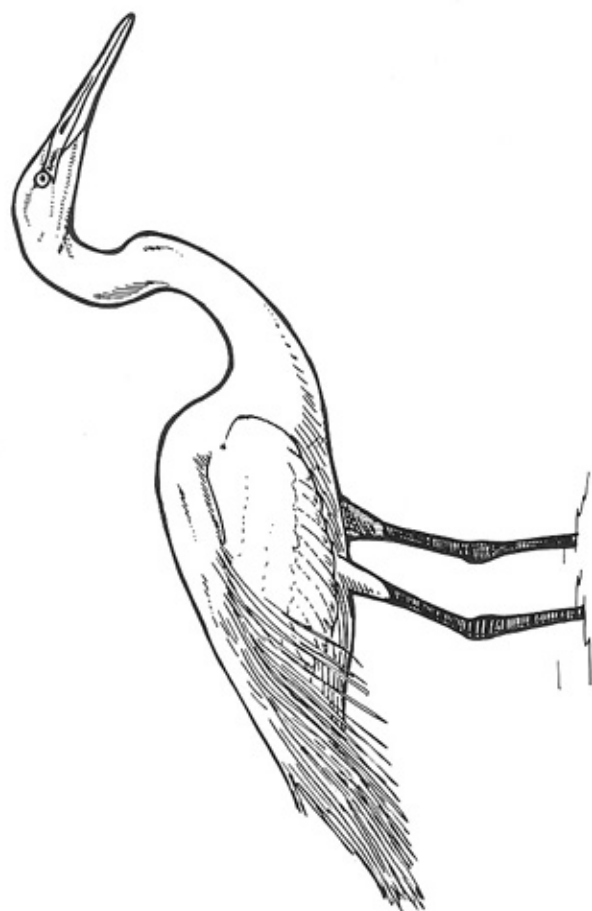


Great Blue Heron

Coot

Greater
White-Fronted
Goose

Great Egret

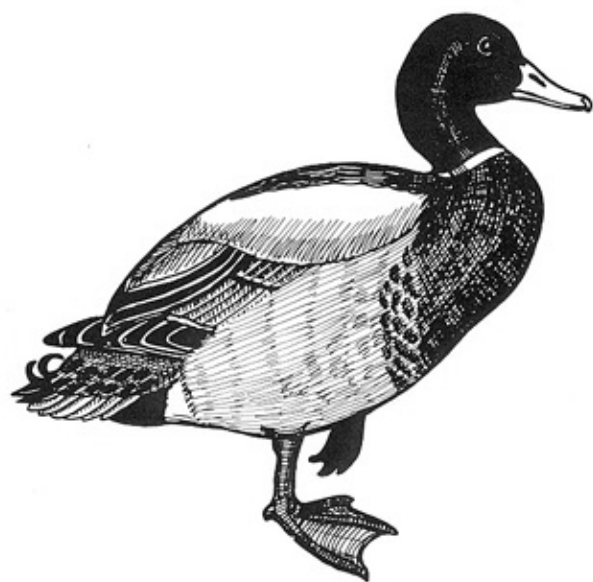
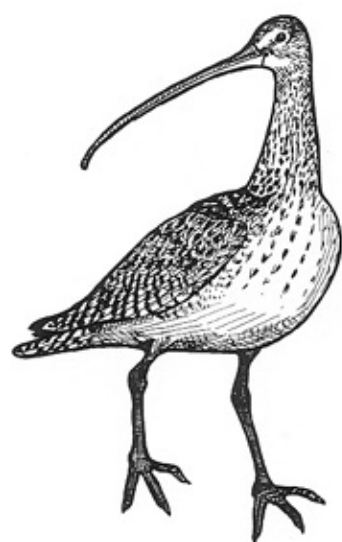


Long-billed Curlew

Killdeer

Northern Flicker

Mallard

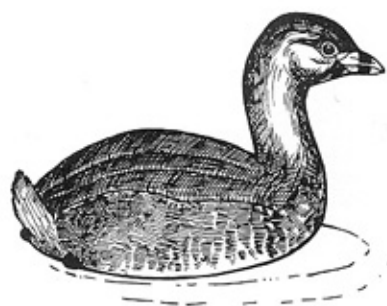
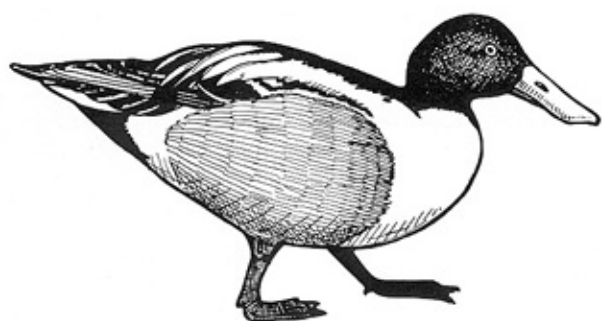
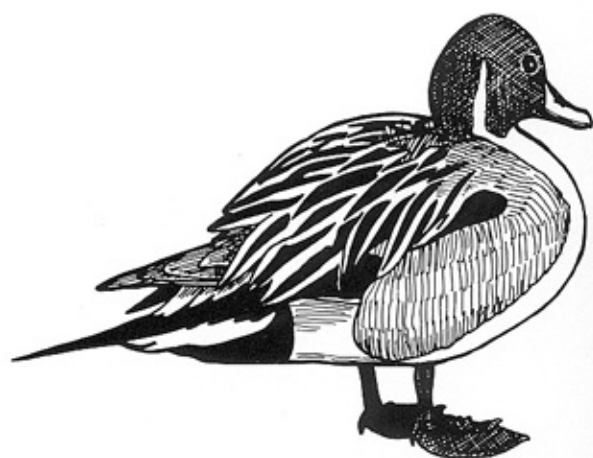


Northern Pintail

Northern Harrier

Pied-billed Grebe

Northern Shoveler



Ring-necked Pheasant

Red-winged Blackbird

Sandhill Crane

Ruddy Duck

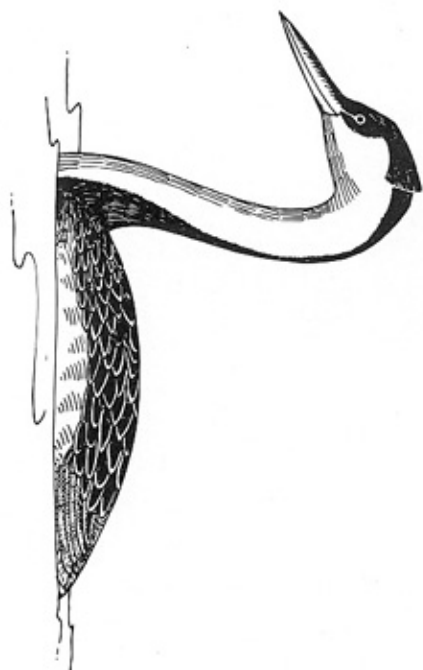
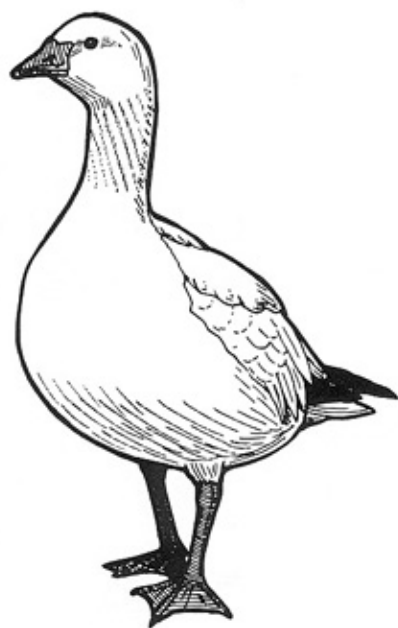


Western Grebe

Snow Goose

Wood Duck

Western Meadowlark



Name _____

Migration Identification

When studying migratory birds, it is important to be able to identify them in flight. Here are the outlines of seven migratory birds from the Central Valley. Can you identify *any* of them? *Some* of them?

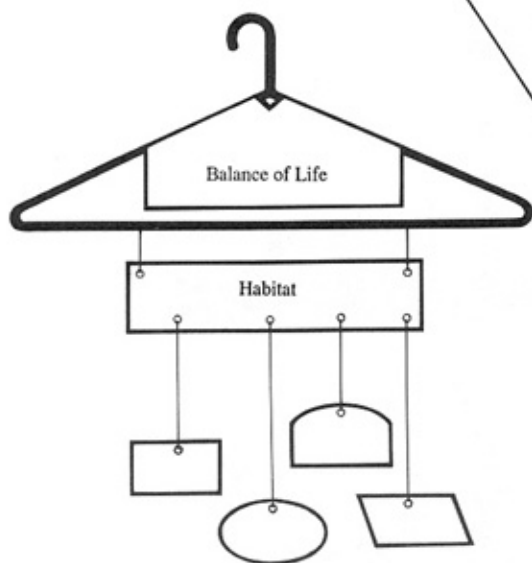
Answers below.



HABITAT MOBILE

4 Requirements for Habitat

1. Run all sheets on tagboard.
2. Have students color letters and cut out pieces.
3. The "Balance of Life" jacket fits over the top of a hanger.
4. Arrange and hang the pieces as shown below.



Habitat

Cut Out

Cut Out

Cut Out

The Balance of Life



Food

Water

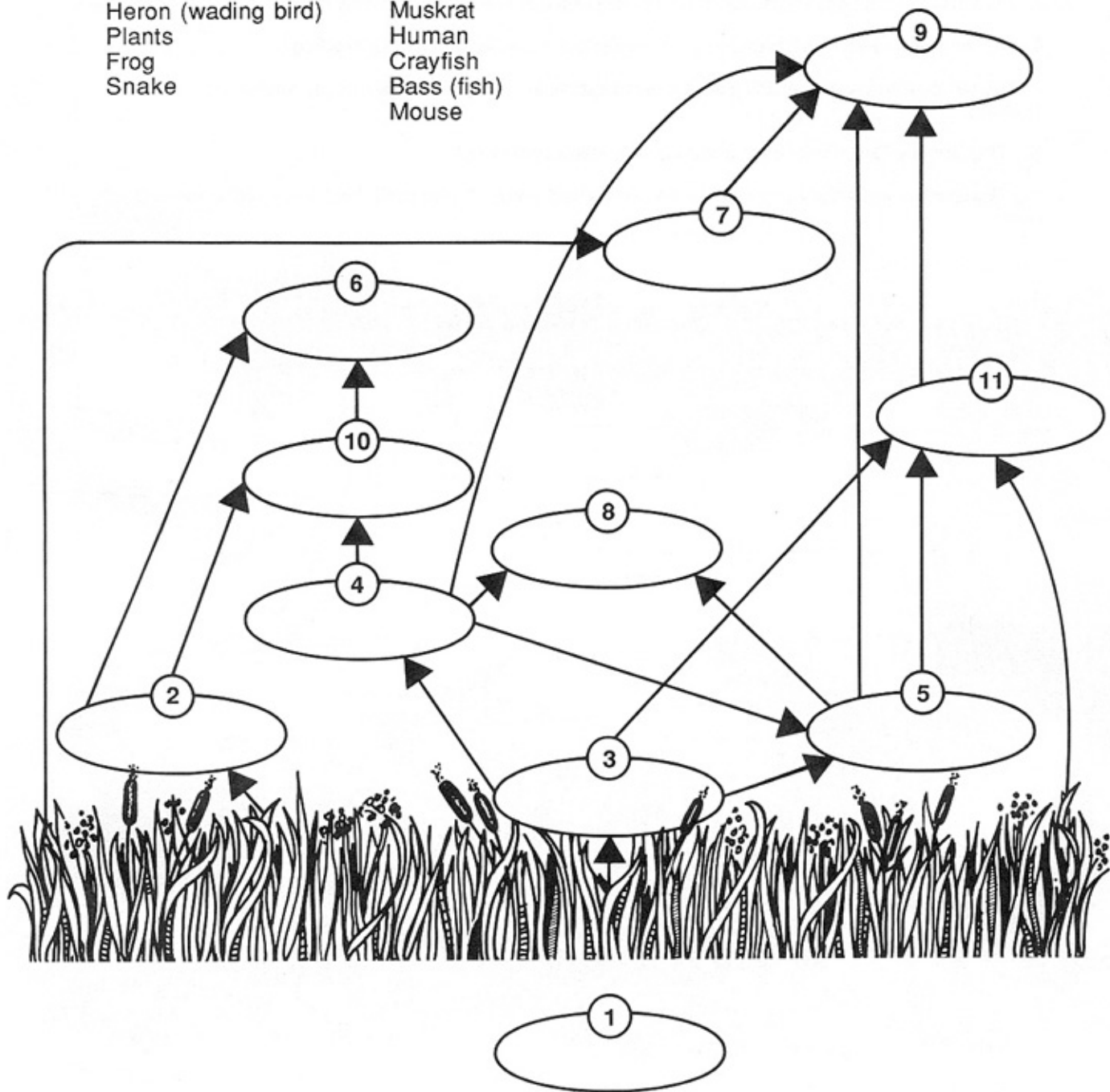
Freshwater Marsh Food Web Puzzle

Every creature has to eat. Some food comes from plants and some from animals. Most creatures eat many different things. Plants and animals, including humans, are all linked in a "food web".

Here is a simplified food web from a freshwater marsh area where pioneers might have settled 200 years ago. Read the clues and see if you can work out the web. Use the words below to fill in the correct numbered places. (Note: The arrows point away from the "food" toward the creature that eats it.)

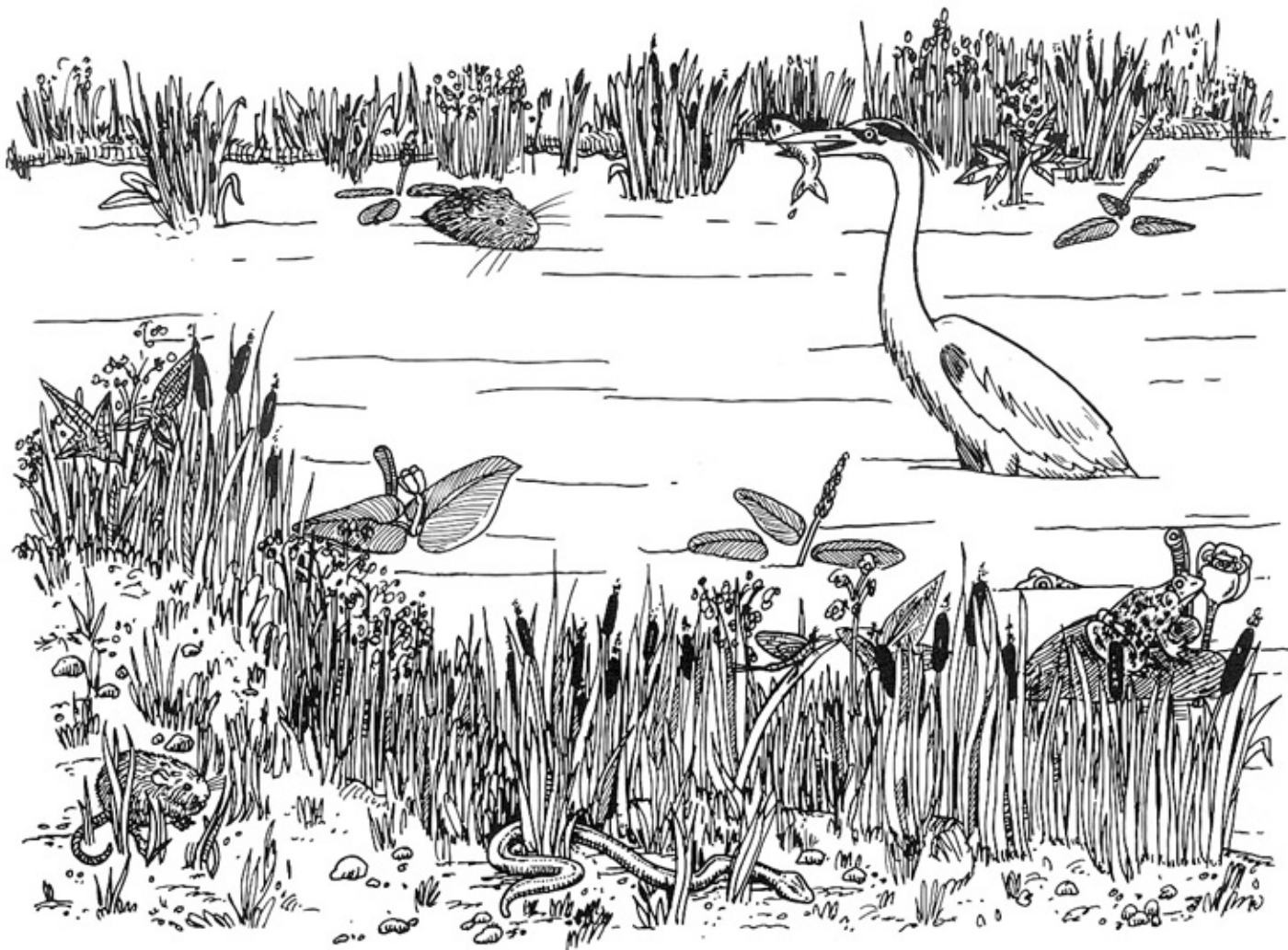
Mayfly
Heron (wading bird)
Plants
Frog
Snake

Owl
Muskrat
Human
Crayfish
Bass (fish)
Mouse



Clues

1. These living things use energy from the sun to make food. They provide the most food in the entire world.
2. This small marsh rodent eats plants and sometimes insects.
3. The larva of this flying insect feeds on plants.
4. This creature eats insects; it stays close to water but is sometimes found on land.
5. This animal lives all its life in the water and feeds on insects and frogs.
6. This bird hunts at night for snakes and mice.
7. This small mammal was hunted for its fur; its meat was also eaten. It eats mostly plants.
8. This long-legged bird wades among plants in shallow water, looking for fish and frogs.
9. This creature can find many things to eat in the marsh, including plants, fish, frogs, crayfish and muskrats.
10. This long reptile hunts for frogs and mice. It swallows prey whole.
11. This creature looks like a small lobster and swims backwards. It eats small dead fish, insect larvae and plants.



Answers: 1. plants, 2. mouse, 3. mayfly, 4. frog, 5. bass, 6. owl, 7. muskrat, 8. heron, 9. human, 10. snake, 11. crayfish.

PUT ME IN MY PLACE!

Habitat Match 4 - 6

SNOW GOOSE	A
AMERICAN COOT	B
WESTERN GREBE	C
RUDDY DUCK	D
CANVASBACK	E
CINNAMON TEAL	F
PINTAIL	G
MALLARD	H

Likes to feed in grasslands and grain-fields.

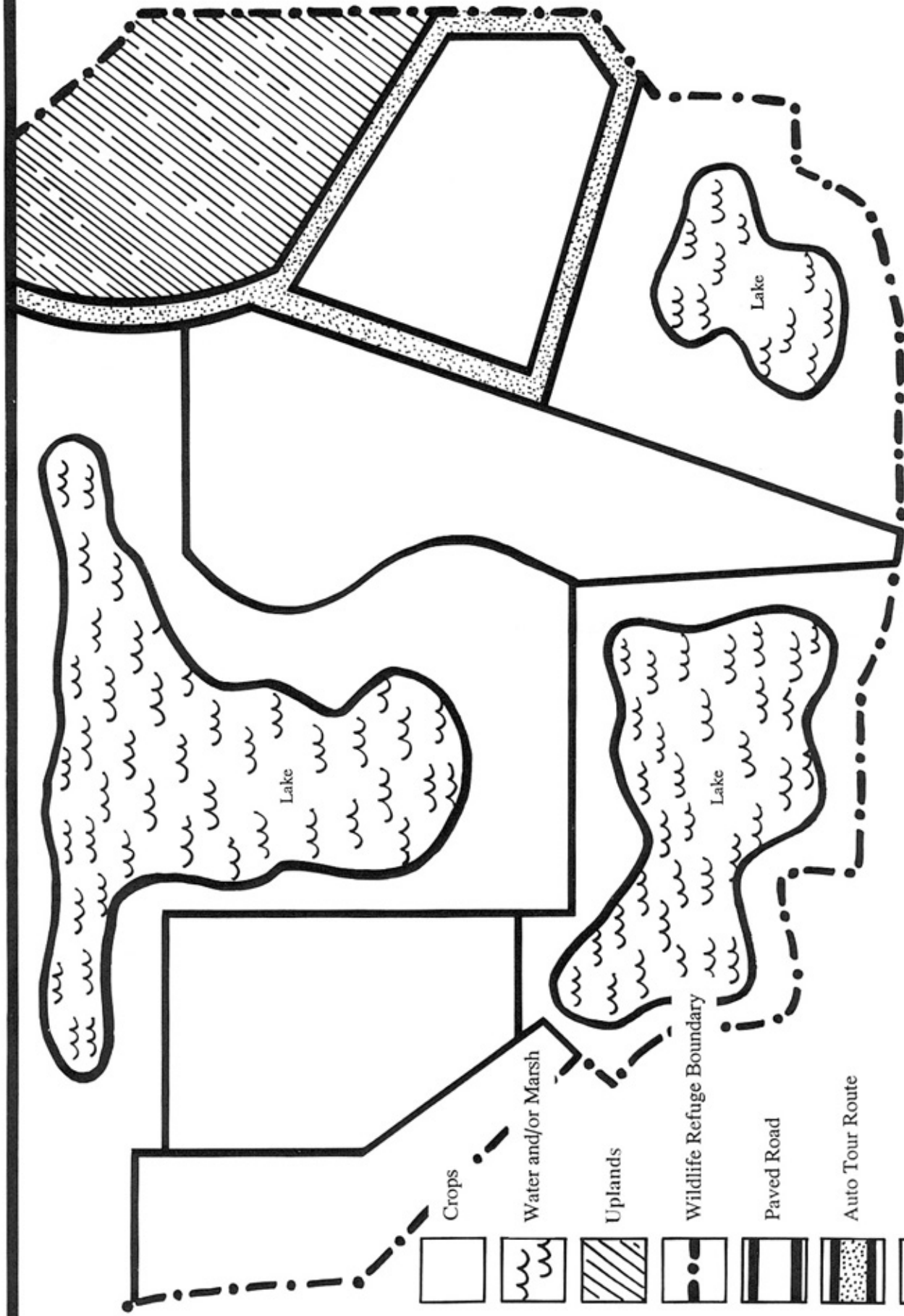
Can be found in the water or wandering on the edges of the water. This bird can walk along on lily pads.

Found on open water where it builds floating nests.

The Ruddy Duck and the Canvasback are *diving ducks*. The Ruddy Duck is found in marshes, lakes and ponds. Canvasbacks like open lakes and marshes.

The Cinnamon Teal, Pintail and Mallard are *dabbling ducks*. They feed by tipping tail up to reach aquatic plants, seeds, and snails. The Cinnamon Teal can be found on ponds and in lakes and marshes. The Pintail will be in marshes and open areas with ponds or lakes. The Mallard enjoys the water, but can be found in many places on the refuge, so you can put it where you like!

A Wildlife Refuge is a special place for birds and other animals. Government workers take care of the Refuge so that it will always be used by the wildlife. Different kinds of birds like to be in different parts of the Refuge. Read about the birds, cut them out, and put them where they like to be. Or, take the short cut - write the letter that is next to the bird in the part of the refuge where you would find that bird.



Name _____

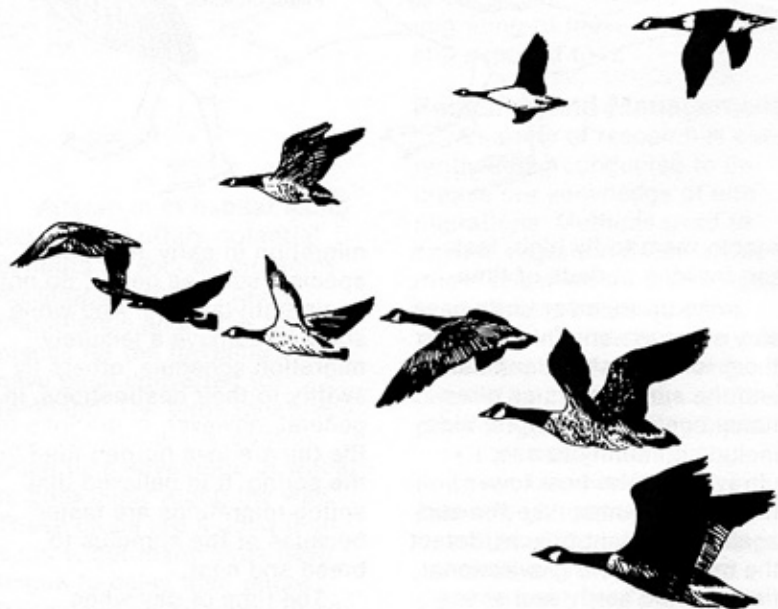
Boundaries of the Refuge Sections

Migratory Birds

In spring and autumn, the sky can become dark with countless birds flying between their **breeding grounds** and **wintering grounds**. This seasonal or periodic movement, called **migration**, is not unique to birds. Various wildlife species ranging in size from butterflies to whales are migratory.

Why Do Birds Migrate?

The reason birds migrate can be explained only partially at this time. Several theories for migration have been identified, and it is probably a combination of factors that stimulates birds to migrate. One theory suggests that changes in weather which affect the availability of food and water cause birds to migrate. Waterfowl obviously cannot feed in frozen lakes and many insect-eating birds leave the north to winter in Central America after feeding on the abundant Arctic insects all summer. A second theory links migration to genetic or inherited characteristics by suggesting that migration is an instinctive return to ancient habitat areas.



Migrating Canada geese

How Do Birds Migrate?

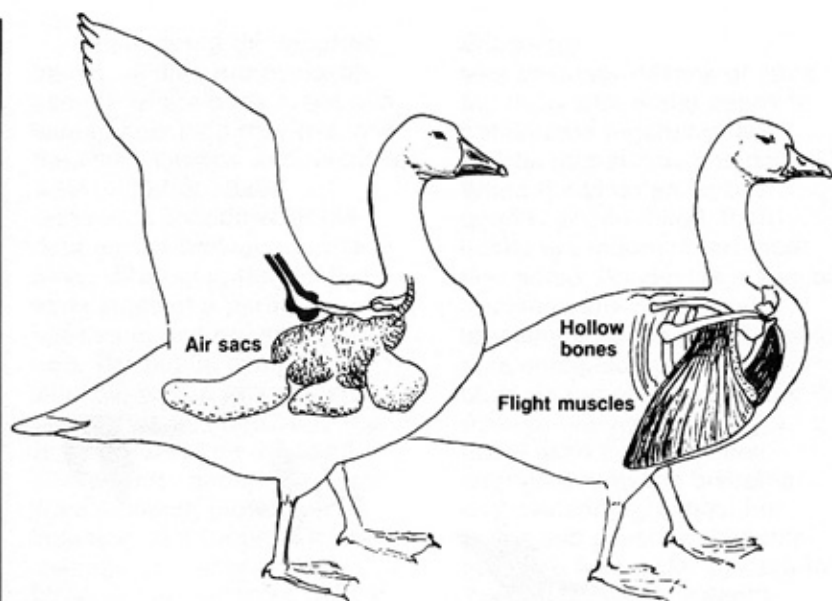
During migration, birds accomplish remarkable feats. For instance, a ruby-throated hummingbird can fly 500 miles in 25 hours, an average of 20 mph; mallards can fly as high as 21,000 feet; geese attain speeds of 50 mph; and greater shearwaters migrate 8,000 miles annually. The destina-

tions of migratory birds are as amazing as their flights. After a journey of 3,000 miles, the Tennessee warbler has been known to return to the same tree in which it nested the preceding year.

Migratory methods are also varied and fascinating. In addition to the usual method of flying, some seabirds migrate by swimming; mountain quail migrate by walking down mountain slopes.

Several senses and adaptations enable birds to migrate. For a start, most migratory birds have very powerful flight muscles. They also have a highly developed respiratory system, hollow bones, internal air sacs, and specialized body shapes. All of these features





enable them to fly high, fast, and for long periods of time.

In addition, most birds have very sharp vision. This enables them to use distant landmarks and the sun or stars as directional cues. Other helpful aids include an ability to see ultraviolet light, hear low-frequency sounds (like the surf against a distant beach), detect the magnetic and gravitational fields of the earth, and sense weather frontal systems and changes in barometric pressure. One or several of these aids may be used depending upon the species and the route traveled.

When Do Birds Migrate?

Times of annual migrations vary. For instance, while many shorebirds begin their fall

migration in early July, other species, such as geese, do not begin until late fall. And while some birds have a leisurely migration schedule, others fly swiftly to their destinations. In general, however, migrations in the fall are less hurried than in the spring. It is believed that spring migrations are faster because of the stimulus to breed and nest.

The time of day when migration occurs also varies. In general, most small birds migrate by night. Ducks and geese may migrate both day and night. Observations made with telescopes focused on the full moon have shown birds migrating over one area at a rate of 9,000 birds per hour! Travel by night enables some of the small birds to avoid their

enemies. In addition, by traveling at night, birds can spend the day feeding and resting. Day migrants include loons, cranes, gulls, hawks, and vultures. Soaring birds such as broad-winged hawks migrate only during the day because they are dependent upon up-drafts created by the sun.

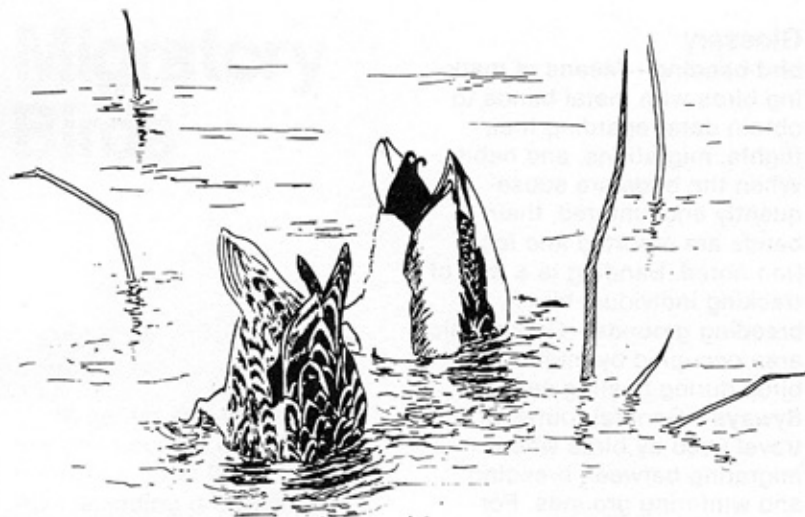
Where Do Birds Migrate?

Migration can take birds from the Arctic to Antarctica. While most species' journeys are not that long, many birds—even small songbirds—do travel impressive distances. This makes bird migration an international concern. Where birds migrate depends on a variety of elements, but the importance of food, water, and shelter must not be overlooked. Many species of birds will seemingly travel several thousand miles out of their way but actually take that route because of the availability of food sources.

While general directions of flight are consistently followed by migrating birds, it is important to remember that the term "migration route" does not mean an exact, specific route between wintering and breeding grounds. Routes tend to follow major habitat types, avoid crossing obstacles like mountain ranges, and provide the necessary food, water, and shelter. Migration routes tend to follow a north-south path, but routes can also include east-west movements.



Nocturnal migrants



Temporary migration stopover

There appear to be four broad migration routes in North America. For research and management purposes these routes are depicted as four distinct **flyways**: the Atlantic Flyway, the Mississippi Flyway, the Central Flyway, and the Pacific Flyway. Of these, the Mississippi route is used most.

Difficulties Along the Way

Despite the many benefits of seasonal movement, a number of problems can occur during migration. Migrating birds are under considerable stress and use up a great deal of energy in sustained flight. A sudden storm that blows them off course or unusually cold weather that reduces their food supply can have disastrous results. Stress also makes them more susceptible to disease, as does the fact that some birds migrate in large flocks where disease can spread easily. Another problem for migratory birds is collisions with skyscrapers, picture windows, radio towers, etc.

Alteration of habitat along the flyways offers potential benefits as well as problems for migrating birds. Many marshlands and other resting places for the traveling birds have been converted to farmland. The birds must feed and rest to survive, so they often take advantage of wheat or corn fields along the way. These crops are a good food source, but many birds have begun to delay their migrations, feeding for long periods in areas with prime supplies. This not only presents a problem for the farmer but also for the birds which may suffer a higher incidence of disease or face severe weather as the seasons change. The conversion of land for many other uses such as housing or commercial development reduces the amount of food available during migration.

Migratory bird populations can also be seriously affected by contact with pesticides. For many years DDT was used to kill insects. Through the food chain process, DDT accumulates in the bodies of birds and mammals. For birds, this can result in thin-shelled eggs, infertility, and sometimes death. While DDT is now banned in the United States, it is still used extensively in other parts of the world. Therefore, birds migrating to these areas are still exposed to it.

Research and Management

A variety of research is currently being conducted to increase our knowledge of bird migrations. Methods used to collect migration data include direct observation, recordings of calls, **bird banding**, radio tracking, radar observation, and laboratory studies involving orientation, navigation, and the physiology of migrating birds.

Of all these methods, however, bird banding has probably yielded the most information. Bird banders trap or net birds and place a metal band on each bird's leg. Each band has a different number on it. This number, along with a description of the species of bird, its age, sex, and date of banding, is sent to the U.S. Fish and Wildlife Service. After the banded bird is released, it may be caught again by banders, die of disease or other natural causes, or be shot by hunters. Information on the recapture, or the band from the dead bird, is then sent to the Fish and Wildlife Service.

By analyzing the reported bands, wildlife professionals can tell where birds breed and winter, how long they live, and the times, lengths, and routes of their migration. Band recoveries provide valuable data for the biologist to use when estimating the relative abundance of a particular species in an area or population. The public can play a valuable role in this research by sending any bird band found to the address on the band.

The information obtained from research provides valuable contributions to the management of migratory birds. Some examples of how research data are used by wildlife experts include how to: combat disease outbreaks, change feeding patterns that are damaging crops, and set harvest limits for migratory bird hunters. Much of the management of migratory birds consists of making sure that adequate habitat exists along the migration routes so birds can rest and feed. Hundreds of private, State, and Federal wildlife refuges have been established to help meet these needs. Similar efforts are also conducted in other countries. This international effort is crucial to the survival of migratory birds.

Research, habitat preservation and management, and international treaties insure that migratory birds will be here for future generations.

Glossary

bird banding—Means of marking birds with metal bands to obtain data regarding their flights, migrations, and habits. When the birds are subsequently encountered, their bands are reported and location noted. Banding is a way of tracking individual birds.

breeding grounds—Geographic area occupied by migratory birds during nesting season.

flyways—General routes of travel used by birds when migrating between breeding and wintering grounds. For ducks and geese in particular, there are four major flyways in the United States: Atlantic, Mississippi, Central, and Pacific. The actual migratory routes of individual bird species may vary from these general flyway patterns.

migration—Seasonal or periodic movement between breeding and wintering grounds. Bird migration varies among species in terms of destinations, time, and duration. Generally migration is accomplished to utilize better feeding grounds.

wintering grounds—Geographic area occupied by birds in the winter. Wintering grounds are usually the most southerly range at which North American migratory birds spend the winter.

Freshwater Marsh

Few people realize the importance of **freshwater marsh** resources to the early settling of America. Trappers in search of beavers and other furbearers that were abundant in marshes, mapped rivers and founded outposts. These outposts later grew into cities such as Chicago, Detroit, and New Orleans. Settlers utilized the freshwater marshes' natural resources. Fish and game harvested there filled many tables. Marshes provided reeds for caning and marginal grazing land for livestock.

Too often, though, marshes were viewed as mosquito-infested wastelands to be used for dumping grounds or to be "improved"—drained or filled for agriculture or construction. Drainage had begun by George Washington's time, and alterations of freshwater marshes and other wetlands have since been carried out on a massive scale.

It is estimated that today the United States has already lost 45 percent of its original wetlands acreage.

During the past few decades, people have begun to realize the ecological values and benefits of freshwater marshes. These valuable functions were noticed when they were interrupted due to wetland destruction.

One of the first values observed was the marshes' importance as habitat for wildlife, particularly waterfowl. As wetlands were destroyed, populations of ducks and geese declined. By 1956, the U.S. Fish and Wildlife Service had developed a wetlands classification system based on their value to wildlife and instituted programs to protect wetlands. At first wetland preservation was focused in terms of wildlife habitat. Now people are discovering that wetland preservation can provide some alter-

native solutions to water supply problems (floodwater storage, **groundwater recharge**, wastewater filtering).

Ecology

A freshwater marsh is an open area, dominated by nonwoody, or herbaceous, plants. Often the vegetated areas are interspersed with patches of open shallow water. Marshes may be flooded for all or only part of the year. However, they must be flooded enough to sustain herbaceous vegetation that is adapted to living in water-saturated soils—plants like cattails and bulrushes.

The freshwater marsh is one of several kinds of wetlands. Other wetlands include bogs, swamps, and salt marshes. They are formed in low-lying areas on river flood plains and coastal plains and in depressions formed by glaciers. Wetlands are more than their name directly implies—



more than just soggy earth, a mere interface between land and water. They are unique ecosystems, different from either land or water.

Freshwater marsh communities include a variety of unique plants and animals. The exact species composition of any particular marsh depends on many things: geographic location, water chemistry, depth and duration of flooding, season, and climate. Most freshwater marshes are very productive habitats. They produce more plant matter per **hectare** (2.47 acres) each year than cropland; and marshes don't need the addition of supplemental fertilizer.

Marsh animals feed on the plants and on each other in what are biologically known as "food chains." Of course, few animals eat only one kind of food, so these simple "food chains" are woven together into a complex "food web." (See Student Page.)

Marsh Wildlife

Freshwater marshes are vital wildlife habitats. Their high productivity supports a variety of creatures. During the breeding season, marshes provide cover, food, and nesting areas. The myriad voices of the spring chorus of frogs and toads reflect



Leopard Frog

this abundance of creatures. Salamanders congregate briefly to lay eggs. The newly spawned fry of sunfish, bass, and bullheads hide among the plants. Birds—songbirds, shorebirds,

and waterfowl—raise their broods in nests among the reeds and cattails. During migration and in the winter, birds use marshes for feeding and resting areas. Many mammals, such as deer, and furbearers like the muskrat, live on the marsh or visit it to feed.

Changing Marshes

Marshes are constantly changing, gradually filling in and becoming land. This takes place through the natural inflow of soil and organic matter from the surrounding area, and through the buildup of dead plant material. As the water becomes shallower, cattails will grow farther out into the open water of the marsh. As the edges of the marsh become drier, the marsh slowly turns into a sedge meadow and may eventually become a forest. This gradual process is known as **succession**, normally occurring over a period of hundreds or thousands of years.

Humans can accelerate the process of succession through carelessness. Marshes fill in by **sedimentation** when **erosion** results from construction or farming in the marsh's **watershed**. Fertilizer runoff from nearby farms and lawns can increase plant growth in the marsh. When the plants die, their decay robs the water of oxygen necessary for fish and other aquatic organisms to sustain life.

In some instances the process of succession is naturally reversed, and new marshes are slowly created or old ones renewed. Over long periods of time, changes in rainfall and the course of rivers, the movements of glaciers, and the geological lifting of the land create new places for wetlands to form. Old, grown-in marshes can be rejuvenated when localized fires burning through the vegetation reopen water pools. The fires release nutrients stored in the dead vegetation and thus contribute to the maintenance of the marsh.

Animals also change wetlands. Muskrats—cutting cattails and bulrushes for food and to



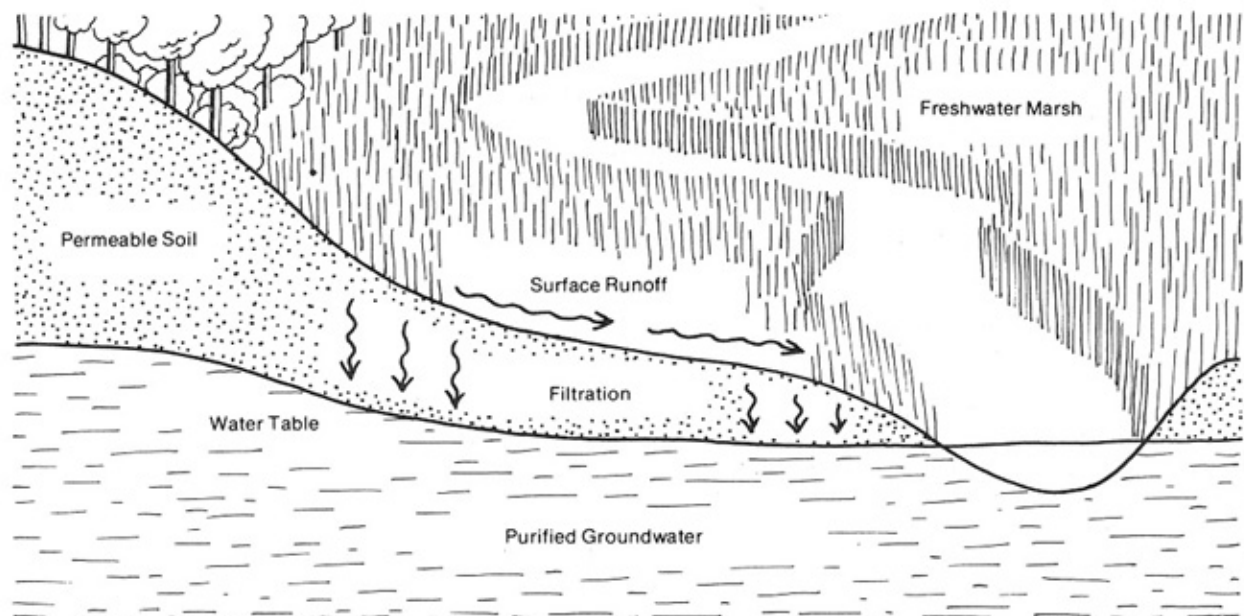
Giant Water Bugs

build their houses—can control the abundance of marsh vegetation. Muskrat "eat-outs" open up dense marshes, making more suitable habitat for ducks and fish that require some open water for swimming and feeding.

Beavers are best known for creating or changing marshes. Beaver dams, sometimes very large, cause flooding and create new wetlands. Forests are "opened up" as trees are killed by the standing water. In a few years the beavers move on to build a new dam elsewhere, leaving a moist meadow behind. This repetitive pattern was more common during the early settlement of this country when beaver populations were more widespread.

Water Resources

Freshwater marshes have important water resource values. Flood control is a natural function of marshes. Their soils and vegetation act as natural "sponges" that have a tremendous ability to absorb and retain excess water. This storage capacity can save the adjacent area from flood damage. During severe flooding in eastern Pennsylvania in 1955, the only two bridges surviving undamaged were located below a large cranberry bog. The presence of wetlands along shores and riverbanks also helps to



Groundwater Recharge from a Freshwater Marsh.

protect these areas from erosion. The dense root systems of the marsh plants hold soil that would otherwise be washed away.

Some of the water stored in marshes evaporates; some may be fed out slowly into streams. Still more of the water may seep underground to recharge the groundwater table. Whether this recharge occurs depends on the soil layers between the marsh and the groundwater. Where the soil is permeable, water will seep through. Recharge is important, especially where groundwater is being pumped out to supply human needs. When marshes are destroyed, rainwater, instead of being stored and seeping back to the water table, runs off and is no longer available for use in that area. Many areas now faced with groundwater depletion would have less serious problems if their wetlands were intact.

Wetlands also function as filters, removing pollution and sediments from water flowing through them. The slow rate of flow through marshes allows solid particles such as sand, silt, and clay to settle out. Nutrients in the water are broken down by bacteria and other microbes and absorbed by plants.

When wetland areas are developed—drained, **dredged**, filled, or channelized—wastes discharged there are no longer purified by normal biological processes. This results in pollution of the water supply. Wetlands can provide this purifying function only to a limited degree. Large amounts of pesticides or heavy metals, for instance, overload the system and threaten all marsh wildlife. Research is currently being conducted on the capacity of marshes to function as sewage treatment plants. Some marshes can process human waste with only minimal impact so long as nutrient loads are not excessive and the contents not too toxic.



Pumpkinseed Sunfish

Management

Most freshwater marsh management today is done by State and Federal agencies, private conservation organizations, and groups interested in hunting. Traditional management programs have been based more on "common sense" than on a real understanding of the functioning of wetland systems. Intensive research is being conducted on wetland ecology to provide a better basis for making management decisions.

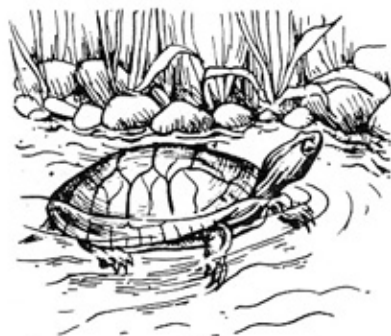
Specific management techniques can be used to improve freshwater marshes for wildlife. Building islands and sowing food plants provide nesting areas and food for marsh wildlife. Techniques can be used to increase natural marsh plant populations wherever water levels can be controlled. The water is "drawn down" in the spring, allowing plants to grow in areas where water was previously too deep. These areas are then reflooded in the fall to make the food available to migrating waterfowl.

Blasting, flooding, and plant cutting are used to create open water areas in very dense marshes. The feasibility of establishing marsh vegetation in normally

drier areas is also being researched with some success. In many cases, the only management a marsh needs is preservation.

Marsh Values

Freshwater marshes are too valuable to be unthinkingly destroyed. Before signing them over for development, people must consider the marshes' importance to the ecosystem. The marshes' connection to the groundwater and potential importance for flood control should be determined. A scattering of marshes is important, providing "habitat islands" for wildlife. Marsh plants help maintain the balance of gases in the air by taking in carbon dioxide and releasing oxygen. Freshwater marshes are valuable as open space, recreation and historic sites, scientific study areas, and for esthetic enjoyment.



Western Painted Turtle

Protecting Our Marshes

As people increasingly recognize the importance of wetlands, laws are being enacted to protect them. The Federal Clean Water Act (Section 404) now requires permits to be issued before dredging or filling of wetlands. Executive Order 11990 also provides for wetland conservation so that Americans will "protect against the cumulative effects of reducing our total wetlands acreage."

Despite these measures, the United States is still losing 300,000 acres of wetlands every year. More public support is still needed for programs encouraging conservation of freshwater marshes.

Glossary

dredging—Deepening a waterway by digging up the bottom.

erosion—The wearing away of soil by water or wind.

freshwater marsh—A wetland that contains freshwater and is dominated by herbaceous vegetation such as cattails and reeds.

groundwater recharge—Replenishment of the underground water supply.

hectare—Measurement of area in the metric system; 1 hectare (10,000 m²) = 2.471 acres.

sedimentation—The process of suspended solid materials (e.g., sand, silt, plant matter) settling out of water.

succession—A gradual, natural sequence of changes in the plant and animal communities occupying a given area.

watershed—The area of land that drains into a particular body of water.

Wetlands Conservation and Use



Water purification

"A dawn wind stirs on the great marsh. With almost imperceptible slowness it rolls a bank of fog across the wide morass. Like the white ghost of a glacier the mists advance, riding over phalanxes of tamarack, sliding across bog meadows heavy with dew. A single silence hangs from horizon to horizon."

—Aldo Leopold
A Sand County Almanac

This peaceful beauty is only one of many wetland values.

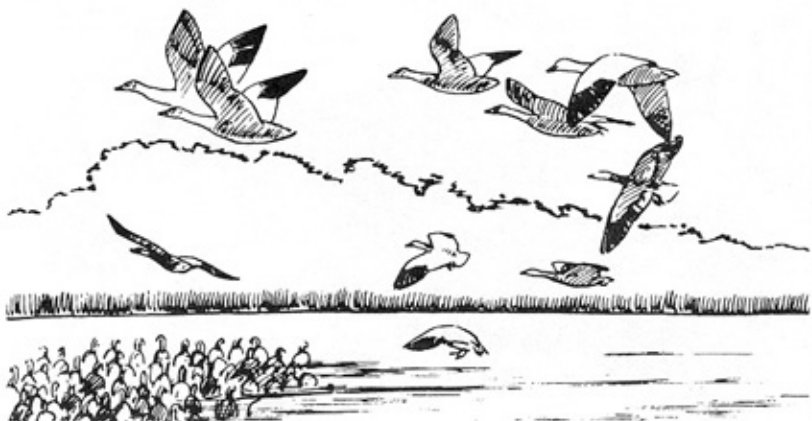
Wetland Characteristics

Wetlands are places of interface between land and water. Though they may be flooded only occasionally during spring thaw or daily by the cycle of tides, water is the key feature controlling the life of the wetland ecosystem. Unique **hydric** soils and plants adapted to living in water-saturated conditions characterize

wetland areas. Common names for different types of wetlands are swamps, bogs, freshwater or salt marshes, potholes, and sloughs.

These wetland systems have inherent natural values. They provide nursery and breeding grounds for fish, shellfish, waterfowl, and other wildlife. The highly productive wetland plants are the primary food source for these animals. Wetlands perform

important **hydrologic** functions including water purification, **groundwater recharge**, and flood and erosion control. Unfortunately, these values went unnoticed for a long time while "worthless" wetlands were destroyed in efforts to "improve" them. The following table summarizes the benefits of natural wetlands to wildlife and people and the uses of developed wetlands.



Functions/ Uses	Natural Wetlands	Developed/Drained Wetlands
Wildlife Habitat	<ul style="list-style-type: none"> • Provide essential nesting, feeding, and wintering sites for waterfowl. • Provide food, water, and cover for many species of game and fur-bearing animals. • Provide breeding or nursery grounds for many species of fish and shellfish (including 2/3 of the commercial species). 	<ul style="list-style-type: none"> • May support a different type of flora and fauna, but not generally wetland species. The problems of wetland destruction first became noticed due to a dramatic decline in populations of ducks and geese.
Water Resource Values	<ul style="list-style-type: none"> • Provide water purification because wetland plants and soil organisms absorb or break down many pollutants. Researchers are examining wetland use for wastewater treatment. • Recharge groundwater. Water held in wetlands may seep down to replenish the water table. • Provide flood and erosion control by temporarily storing excess water. 	<ul style="list-style-type: none"> • Cause loss of water resource values after which deterioration of water quality or increased flooding may result. • Often requires construction of alternative solutions such as levees, dams, and treatment plants to replace formerly "free services."
Food Crops/ Productivity	<ul style="list-style-type: none"> • Provide food for people and other animals such as fish, shellfish, and waterfowl. Many wetlands are highly productive, with more plant growth per hectare than farmland. • Furnish areas for commercial crops such as cranberries, wild rice, and marsh hay. 	<ul style="list-style-type: none"> • Usually easier to farm through small pot-holes than go around them. • Often result in soil destruction and loss of soil fertility; however, wheat, soybeans, and other crops may grow well in drained wetlands.

Indirect Human Impacts

In addition to the direct impacts of filling and draining, people have indirect impacts on wetlands. Industrial cooling water discharged into wetlands raises water temperature (heat pollution), sometimes killing animals or changing their life cycles. Wetlands are polluted by spills, discharges, or runoff of oil or chemicals.

The introduction of nonnative species, which have few natural enemies, also affects wetlands. For example, carp, a native fish of

Asia, has thrived in many U.S. freshwaters. This fish "roots" in the bottom for food, raising clouds of sediment that can cause a variety of problems. For instance, this disturbance clouds the water, thus reducing light penetration. This in turn may cause a decrease in photosynthesis, which eventually reduces the amount of oxygen available to plants and animals.

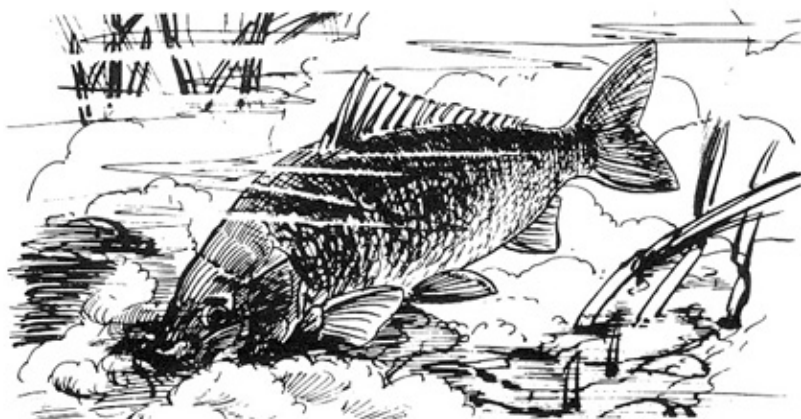
A second example of problems with introduced species is the purple loosestrife plant. It was brought into the United States in

the early 1800's by a garden club and is taking over habitat once occupied by cattails. While some people consider purple loosestrife attractive, it is less nutritious than cattails. Ultimately, this affects food relationships in those wetlands dominated by purple loosestrife.

Choosing Priorities

Development of wetlands often impairs or destroys their natural functions. Before people became aware of these functions, filling, draining, or dumping on wetlands seemed the only way to make them useful. Now comes a need for careful balance. Does developing a wetland have more value than leaving it alone? The answer is not always simple.

Certainly different sites can be found for garbage dumps. But wetlands destruction is also spurred by the demand for jobs, food, and homes. Wetlands are drained for agriculture or filled for cheap, flat residential land or prime waterfront property. How are these values to be balanced?





Wetland Protection and Planning

The first wetland protection programs were aimed at preserving wetlands important to wildlife, particularly to migrating birds. Federal and State agencies purchased wetlands or **easements** on them through the Waterbank or Migratory Bird Conservation Programs. Private agencies (such as The Nature Conservancy, Ducks Unlimited, and others) added to the conservation effort.

Increasing public realization of wetland values has led to broader programs for planning and preservation. The Clean Water Act requires permits for some wetland dredging or filling projects. The permit evaluation process ensures that public losses as well as benefits from proposed projects are considered. The Coastal Zone Management Act encourages States to consider development trade-offs in coastal wetlands. Many States have laws or public land management policies affecting wetlands; some offer tax relief programs for owners of wetlands.

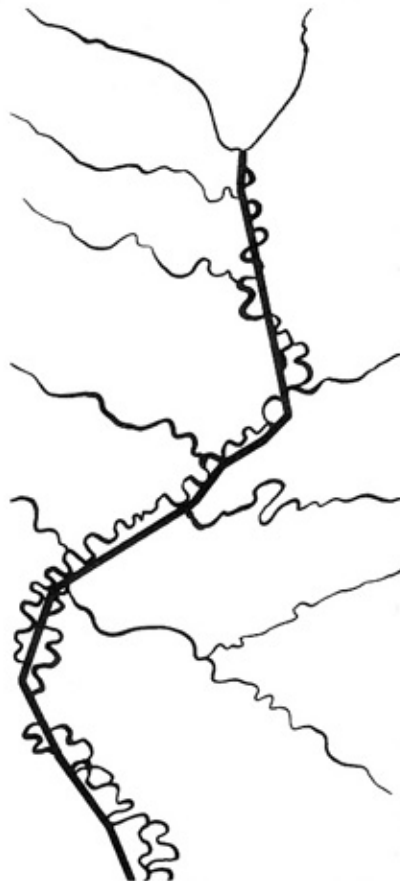
Learning to Plan

Planning for wetland use and conservation requires knowledge of how wetland systems function. Research is now providing some needed information. Unfortunately, some lessons have been learned through hard experience. For example, some soils drained for agriculture were too acid or too salty for crops. Draining of

prairie **potholes** has decreased waterfowl populations. Building sites located on former wetlands are often subject to recurring floods or storm damage.

A case in point is the **channelization** of the Kissimmee River, which flows into Lake Okeechobee in southern Florida. In the mid-1960's, this 100-mile-long meandering river was straightened into a 50-mile canal

to drain and control floods on surrounding land. Soon water quality in Lake Okeechobee, the drinking water reservoir for the southern part of the State, began to deteriorate. What happened? Prior to channelization, the flowing water was slowed and filtered in the winding river and the adjacent wetlands. After channelization, runoff from adjacent farms and grazing land flowed quickly



Channelization of the Kissimmee River



and directly into Lake Okeechobee without benefit of the natural pollution removal. The river and marsh may now have to be restored to accomplish this important function.

Habitat Management

Planning for wetland uses is often an either/or trade-off decision because wetlands cannot be managed both for development and for natural values.

Preservation of wetlands is important to maintaining its wildlife values and, in most cases, proper management can enhance wetland habitat. **Moist soil management** can be used to control marsh plant populations wherever water levels can be manipulated. For example, water levels may be "drawn down" in spring, allowing plants to grow in areas that were formerly flooded. Reflooding these areas in the fall makes the food available to migrating waterfowl. Plantings and nesting boxes may be located where food or nest sites are insufficient.

Plans for development should not assume that wetland areas are useless. Wetlands are proving more and more to be invaluable resources. Their further loss would be both costly and sad, as so eloquently described by Aldo Leopold:

"Some day my marsh, dyked and pumped, will lie forgotten under the wheat, just as today and yesterday will lie forgotten under the years. Before the last mud-minnow makes his last wiggle in the last pool, the terns will scream goodbye... the swans will circle skyward in snowy dignity, and the cranes will blow their trumpets in farewell."

Our increased knowledge and appreciation of the wetlands' natural "work and worth" can help ensure their presence for future generations to enjoy.

Glossary

channelization—A process by which people modify the shape and course of a streambed to provide a more direct waterflow.

easement—Legal rights (for a nonowner) written into a real estate deed for a specific purpose—such as wetlands protection activities.

groundwater recharge—Replenishment of the underground water supply.

hectare—Measurement of area in the metric system; 1 hectare (10,000 sq m) = 2.47 acres.

hydric—A term used to describe particular types of soils formed under wet conditions.

hydrologic—A term pertaining to water—its properties, distribution, or circulation.

moist soil management—The process of controlling water levels in a marsh so that natural wild foods are abundantly produced for wildlife.

pothole—A shallow, water-filled depression of glacial origin found primarily in the northern Great Plains. Potholes characteristically have cattails, grasses, and abundant aquatic life.